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CONTENTS.

ILLUSTRATED ARTICLES:	PAGE.	SPECIAL CORRESPONDENCE:	PAGE.
Delany's Electrical Bulletin Board	38	New York Notes	46
The Baxter 100,000 Watt Generator	39	New England Notes	46
EDITORIAL:		Philadelphia Notes	47
Paragraphs	37	Western Notes	47
MISCELLANEOUS:		Southern Notes	47
Another Bell Telephone Victory	38	Canadian Notes	48
Detecting Leaks in Underground Conductors	39	English Notes	48
Weston's New Alloys for Electric Conductors	39	DEPARTMENTS:	
The Admission of Alternating Currents into New York City	40	The Telegraph	49
The Incandescent Lamp Suits in England	46	The Telephone	49
		The Electric Light	49
		Applications of Power	49
		Personals	49
		Miscellaneous Notes	49
		Business Notices	49
		Our Illustrated Record of Electrical Patents	50

Control, Not Prohibition.

SHALL electricity distributed by means of the alternating current be permitted in this city? This is the question which the Board of Control has now before it for settlement, and which will require its best efforts to solve with satisfaction, both to itself and to the public, whose interests it was appointed to guard. Roused by a letter published in the *Evening Post* of this city, in which the alternating current is described in anything but glowing terms, the adherents of this system have made haste to protest against the carrying out of the recommendations contained in that letter, and state their reasons therefor. Analyzing broadly what has been said by the various petitioners to the Board, as well as by others whose opinions have been officially invited, it may be said that they rest their case principally upon the record made by the alternating current during the last two years, and, considering that, they have adopted the best course. The one question at issue seems to be the danger to life which this system of distribution involves; but on this point opinions are so much at variance, and the facilities for experiment are unfortunately so meagre, that a definite conclusion is at present difficult to arrive at. But we think that the argument advanced by one of those who addressed the Board meets the case, if carried out to its full extent, and that is *control*. In other words, Mr. Peck argues that, instead of prohibiting the admission of the alternating current into this city, it should be allowed to enter, so controlled that accident through its use will be impossible. The whole question then resolves itself into whether alternating current circuits of 1,000 volts potential can be successfully run underground without developing such faults as to make the system dangerous. There is thus merely a question of fact to determine, and one which, indeed, according to some of the communications, has virtually been already settled. Thus far, only the friends of the alternating system have been formally heard by the Board, and no doubt its opponents will soon have an opportunity to be heard at equal length, unless they are satisfied with Mr. H. P. Brown. This question of the admission of alternating currents is one which not only affects New York, but every other large city in this country as well, and hence the decision arrived at by the New York Board must be regarded as of national importance in the application of electricity. We have, therefore, given the matter in extenso in this issue.

Coast Life-Saving Stations.

A GREAT improvement in the life-saving stations on the Atlantic coast is to be effected by giving them intercommunication by means of the telephone, while those isolated from the mainland are to have telephonic or telegraphic connection with the nearest shore villages. This is an excellent step, and as has recently been pointed out in England, where a similar measure is under discussion, the service will not be without strategic advantages in both military and naval operations should the emergency arise.

Electrical Bulletins.

THE great thirst of Americans for news, like the old Athenians, has led to the development of the stock and news ticker in this country far in excess of its use in any other country; and though perfection seemed to have been reached many times, it was excelled by still later improvements, so that many early forms have become entirely obsolete. After seeing several kinds of printing instruments come and go, we now note the appearance of an electrical bulletin, which is not intended to leave a record of the news it conveys, but is designed merely to satisfy the eagerness for news, and then makes room for a succeeding announcement. Mr. Delany has shown great ingenuity in working out this system, and we believe that it has a very large field of usefulness before it.

Converts to Electric Railways.

THE appearance of Mr. Henry M. Whitney before the selectmen of Brookline, Mass., as an advocate of electric railways, deserves special notice on the part of all interested in street railway enterprises. Mr. Whitney's West End Company of Boston proposed to put in a cable system and had made all the necessary preparations, believing that electricity was not yet ready to do such heavy work as would be demanded. But Mr. Whitney was not satisfied until he had made an examination of the results obtained with electricity at Richmond, Va., and Allegheny City, and, as might be expected, after seeing with his own eyes what electricity can do, he is a thorough convert to the new power. His speech before the Brookline board was one of the most eloquent and convincing arguments yet presented in favor of electric locomotion. "I believe," said Mr. Whitney, "that the electric motor at this day has reached that stage of development which makes it a perfectly practicable working machine, superior in all respects to horses for quick transportation," and he goes on to point out its advantages also over the cable. Such evidence as this from the outside is not to be gainsaid. It is simply the recognition by a leader in the world of finance and commerce of the claims that have been made by electricians, and it will stand, every month giving it greater weight and validity.

New Alloys for Resistance Coils.

ONLY recently a paper read before the American Institute of Electrical Engineers drew attention to the inconvenience caused by the heating up of standard resistances by the passage of the current, and an ingenious arrangement was shown by Prof. Nichols by means of which this difficulty could be obviated. This, it will be remembered, consisted in the application of the phenomenon exhibited by carbon of lowering its resistance when heated in contradistinction to the property of copper and metals generally, which increase in resistance with increase in temperature. It is interesting to note that what has heretofore been considered only an attribute of carbon and a few other solids of analogous nature, has been found by Mr. Weston to be also possessed by a metallic alloy, and by its means he is able to compensate for the unequal action of coils due to the heating. Mr. Weston also brings out another alloy of not less importance than this, one which is said to have the valuable quality of remaining practically constant in resistance over wide ranges of temperature. The great advantage of this alloy for all standard electrical instruments must be obvious, as it will avoid many inconveniences now attendant on the use of the present alloys.

The Direct System and Storage.

AFTER many suggestions as to the advisability of running the underground railway in London by electricity, we learn that at last steps are being taken to put the scheme into practical operation. While this is evidently good news from the electrical standpoint, our readers will probably learn with varied emotions that it is actually proposed to employ storage batteries as a source of power to drive locomotives, working up to 600 h. p. We are as yet not in possession of sufficient details to permit of a thorough discussion of this project, but judging from what there is to be gathered, the undertaking as proposed is open to various objections. It seems hardly possible that the idea of employing 600 h. p. of storage batteries to every train can be seriously entertained, when we consider alone the weight of these batteries. Even with the considerable reduction in weight which we are promised from various quarters, in the near future, the scheme is one which must strike the electrical engineer as a strain which electricity would hardly be able to stand. In making this statement, it is not to be understood that the storage battery has no field of usefulness whatever in railroad work, for we believe that the time is not far distant when storage battery street cars will everywhere find application; but the running of express trains weighing 100 tons and over by such means must lead to unfortunate results, militating even against the final adoption of any other electrical system. Indeed for this reason, if for no other, we hope that the report which we have above noted is not well-founded, and that a direct method of distribution will be adopted on the London underground. Nothing better than direct supply of current could be asked for a road like that.

Foreign Electrical Patents.

As announced in our special cable dispatches last week, two important patents have just been declared invalid in England, and peculiar interest attaches to the matter from the fact that patents bearing on almost the same inventions are now before our own courts for adjudication. Taking up, first, the decision in relation to the Edison lamp patent, it would seem that it is largely based on the evidence rendered by Professor Stokes, as independent reporter upon the experiments made in order to determine if the specification of Edison was sufficiently clear and distinct to enable one skilled in the art to make a lamp. This report showed that in the opinion of the plaintiff's experts the manufacture of the tar-putty filament was feasible, and that lamps could be made therefrom, while the experts of the defendant did not succeed in making filaments by this process. It is not necessary to enter into details of these experiments, but they go to prove, as has often been demonstrated before, that the successful carrying out of directions contained in a patent specification depends greatly upon the skill and judgment of the workman. The judge in his decision, however, preferred to lay greater stress upon the unsuccessful attempts than upon the successful ones, and this, in connection with other points, was the basis of his decision. With reference to the Gaulard-Gibbs patent, the decision, which we have already published, is to the effect that the specifications and claims are not sufficiently clear, aside from the other question of priority. In order that our readers may know the exact meaning of this decision, we quote here the claims attached to the Gaulard-Gibbs patent, which has just been decided invalid, and in which the words which stand in the original specification, but which have since been deleted by permission of the controller of patents, are inclosed in brackets:

First, the privilege of exclusively working our process of distribution, characterized by the following points, as above explained. The employment of an alternating current of a high tension for the generation in [unlimited] a number of secondary generators of induced currents individually utilized either for the production of light or motive power. Second, a system of electrical distribution, such as is laid down in the foregoing statement. [Third, the special construction as described of secondary generators, designed to produce this result.]

While this patent is thus invalidated, it must be borne in mind that there is at least another English patent by the same inventors which, it is claimed, still controls this method of distribution. While, to a casual observer, these very interesting decisions may appear to have considerable influence on the same questions now at issue in this country, it seems doubtful whether this is really the case, judged in the light of past experience. Thus, we need only call attention to the fact that while in some foreign countries well-known patents have been declared invalid, the same have been upheld in this country, in which the rights of the inventor are more carefully guarded and preserved than abroad, our laws being more liberal to the inventor. Hence, it would be ill-advised to form a hasty opinion on a subject which presents so many phases for consideration. Besides, it is more than probable that these recent decisions will be appealed from to a higher court.

Delany's Electrical Bulletin Board.

In order to accomplish a distribution of news to subscribers similar to the system in which news "tickers" are employed, but without the inconvenience attending to use of the latter, Mr. P. B. Delany, of this city, has just brought out an electrical news bulletin for simultaneous distribution among subscribers throughout a city, of announcements of leading interest. As will be seen from our illustration, Fig. 1, it is a *visual telegraph*. There is no printing or record of any kind, and, being entirely electrical, there is no winding up mechanism, no inking or paper, and consequently no inspection or attendance necessary,

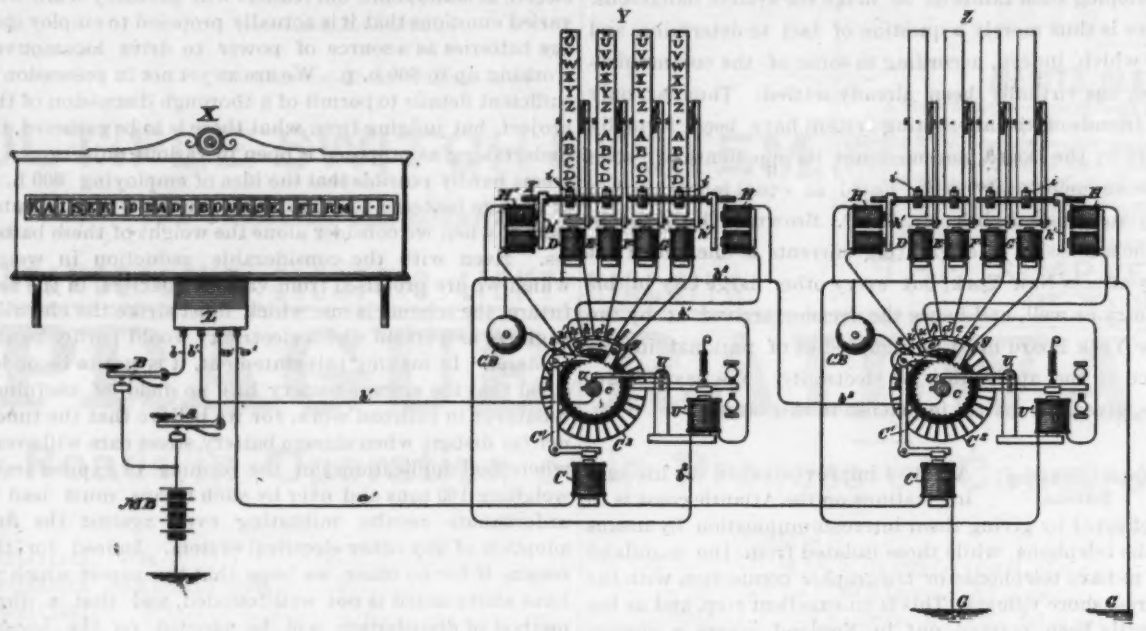


FIG. 1.—DELANY'S ELECTRIC NEWS BULLETIN.

as with the present news ticker systems. Thus much expense is saved and annoyance to subscribers avoided. The bulletin hangs on the wall like a clock and need not be disturbed from one year's end to another. When an item of news is sent attention is called to it by a few taps of a bell and everybody in a large room or hall may look and learn at a glance what has happened. Although details of any event may be sent continuously to the end when occasion warrants, the general object of the service will be to condense news items to the brevity with which announcements are usually made on newspaper bulletin boards.

The inventor claims, and we think correctly, that what the public want, especially during the busy hours of the day, is a bare outline of happenings *on the moment;* the particulars will be looked up at leisure in the newspapers.

The scope of the machine for a single announcement will be about twenty-five letters, although this limit might be extended to three or four times this number. It is believed, however, that any event can be announced intelligently within the limit of twenty-five letters, as, for instance, the important item shown in the drawing. Here is not only the startling announcement of the death of the Kaiser, but also that the stock market has not been upset by the event. For a business man, banker or merchant, or in fact for the great majority of people, this is amply sufficient until such time as opportunity and inclination leads to a perusal of all the particulars in the newspapers.

It is surprising how much may be expressed in a few words, and none understand the art of condensation as well as telegraphers and journalists. Doubtless Mr. Delany was largely influenced by a keen appreciation of the *expanse of brevity* in the construction of his bulletin instrument. We quote a few specimen announcements furnished by the inventor as an illustration of the scope of the bulletin: "Stocks open firm;" "Umbria Sandy Hook leaking;" "Sheridan ard. Nonquit btr.;" "Volunteer mile ahead;" "Panic Wall st.;" "Harrison nominated;" "Union Sq. Theatre burning;" "Bard wins, Hanover second;" "Boulanger badly wounded;" "Mills bill passed House;" "War scare Europe revived;" "N. Y. three, Chicago two," etc.

Each announcement remains in view until there is another to succeed it. At times there may be an hour between; at other times important items may follow each other at intervals of a few minutes, all according to the liveliness of the times, of course. If a record is desired, the bulletin may be written down on a slate or blackboard. In fact, this is extensively done by those using the news tickers at present, for it would seem that people do not care to pull over a long line of tape to see what has happened, or be compelled to read a lot of uninteresting details in order to get at the result. It has been observed that not one in a hundred look at the tape of a news ticker, while it is safe to predict that everybody will cast an eye at the bulletin to see the latest news.

It will be readily seen that with this electrical bulletin in banks, offices, counting-rooms, hotels, clubs, restaurants and other places of public resort, all news of importance will be known instantly, and during times of elections or other great excitement the interest with which the bulletins will be watched may be well imagined.

The principle of operation of the system is simple and it is not liable to disarrangement. Referring to Fig. 1 the bulletin X represents a central office, Y and Z details in part of two subscribers' instruments, all in series, showing the manner of operation.

Fig. 2 is an end view of so much of the apparatus as is necessary to illustrate the operation of the wheels and the working of the unison of the bulletin wheels.

Fig. 3 shows a rear view of several of the bulletin wheels.

Assuming that the bulletins at the central office and those at the subscribers' offices are at unison, the operation will be as follows: At the central station is a general transmitter, represented by common Morse keys A and B for simplicity of illustration. The key A is included in a circuit a a', extending from the key through magnets C C of the distributers of the respective bulletins to earth. Each magnet C operates a pivoted armature C', whose pawl works the ratchet wheel c fast on a shaft carrying a trailer e' which traverses a table of insulated contacts C^2. Upon depression of key A the trailer e' of each bulletin is caused to pass from one insulated contact to the next contact. There are thirty contacts shown. Each distributer has an unison arranged to permit a full revolution of the trailer. The circuit of the unison magnet U' is through the line b', trailer e', segment u and the unison magnet. The continuation b^2 of this line being the main line, and leading to the trailer of the next distributer, and so on through all that may be in the circuit, and thence to earth.

By making and breaking the circuit at key A a sufficient number of times, all the distributers will be brought to unison with the trailers e on the unison segments u'. Then by depressing key B the circuit b, b', b^2 will be completed from battery MB, through the various segments, magnets U', to earth, and the unison stops thrown off of all the instruments. They will then be in readiness for the reception and display of any item of news transmitted.

The depression of key A will cause the movement of all the trailers e', from the unison segment u to the next segment h, connected through the coils of magnet H, which removes the unison stops from the several bulletin wheels in the following manner:

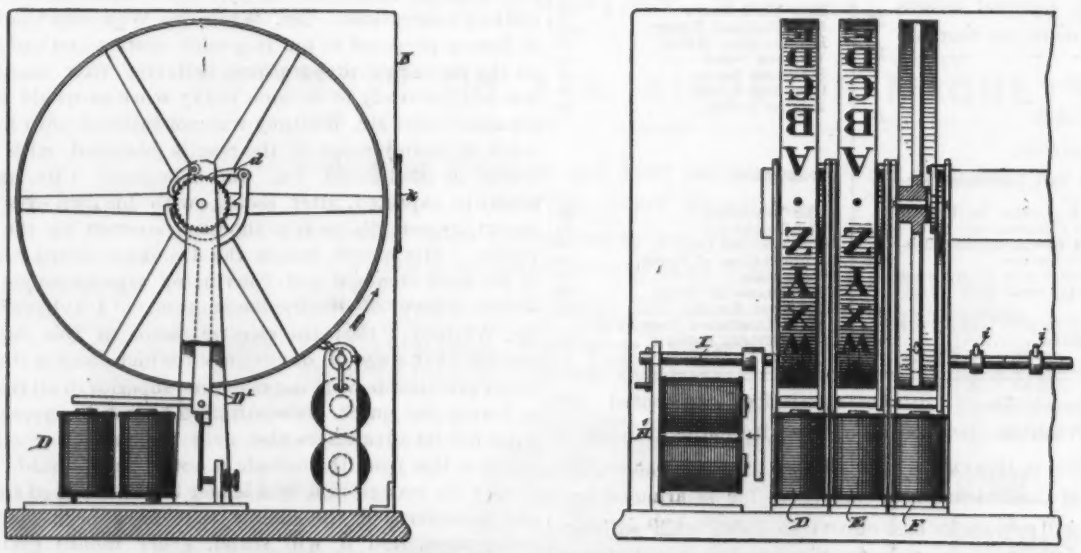
The armature h' of the magnet H is fixed to a shaft I, which slides lengthwise and carries a number of adjustable collars i, secured to the same by set screws, one for each wheel. These collars have stops, against which corresponding projections on the bulletin wheels strike when the wheels are at unison, as shown in Fig. 2.

When the wheels have all been brought to unison, the unison stops are removed simultaneously from all the wheels by closing the circuit through magnet H by key B at the central station when the trailer is on segment h.

Only four bulletin wheels are shown in the figure at Y Z. Their magnets, D, E, F, G, are connected through segments d, e, f, g with the main line b^2. The trailer is then advanced from segment h to the next segment d upon the depression of the key A. By manipulation of the key B the magnet D of the first bulletin wheel may be intermittently energized, and the wheel advanced step by step until the desired letter is exposed to view. In like manner all the wheels are operated when the trailer has been brought upon their respective segments. The manner of propulsion is shown in Fig. 2.

As a matter of course each bulletin wheel carries the entire alphabet, with such spaces or other characters as may be deemed advisable. All the distributer trailers and bulletin wheels are put to unison before each announcement, so that correctness is insured. It requires about one minute to complete a bulletin dispatch.

This system, which can be seen in practical operation at Mr. Delany's office, in this city, will when established, be worked from a central office, where all important news will be collected. Thirty or forty instruments may be worked in a circuit, and all the circuits throughout a city may be operated simultaneously from a single transmitter.



FIGS. 2 AND 3. DELANY'S ELECTRIC NEWS BULLETIN.

Another Bell Telephone Victory.

In the suit at Chicago of the American Bell Telephone Company against the American Cushman Telephone Company, Judge Blodgett decided, on July 21, for the plaintiff, and granted a perpetual injunction restraining the defendants from further infringements of the Bell Company patents. Dr. Cushman's claim was that, in 1851, while experimenting with a lightning arrester, he accidentally discovered the principle of transmitting articulate speech by an electric current, and constructed an apparatus which was used as a telephone. Judge Blodgett, in his finding, says: "My conclusion is that Dr. Cushman, with the aid of W. P. Cushman and B. T. Blodgett, in Racine, during the Summer of 1851, did make a device containing magnetic coils through which spoken words could be and were transmitted at short distances, that the transmission was faint and the words difficult to hear and the attempt to talk through them was often a total failure, and occasionally, when all conditions were favorably, only a partial or meagre success was obtained. * * * I have no doubt from the proof that the machines made by Dr. Cushman, W. P. Cushman and B. T. Blodgett in 1851, were in all practical respects as good as any that were made afterward by Dr. Cushman or those who assisted him. Orrin White tried to improve them, and afterward Joshua B. Cushman made an effort in the same direction, but they were so imperfect in their operation as to offer no promise to any one of their future possibilities. These considerations compel me to the conclusion that all the testimony, when taken together, falls short of establishing beyond reasonable doubt the fact that Dr. Cushman in 1851 invented the telephone, and what was done by him must and should be treated as at best only an abandoned experiment. Besides granting the injunction against the Cushman Company, Judge Blodgett ordered a reference to a master in chancery to determine the amounts to be recovered for the infringement of the patents. In addition a preliminary injunction was granted against the Cushman Telephone and Service Company, which is operating a number of exchanges in Indiana, restraining it from extending its lines or further infringing upon the Bell patents. The Cushman people say they expect to carry the case up to the United States Supreme Court. The decision is said to leave the field entirely clear of active opponents to the Bell telephone, and this, it is claimed, is the first time such has been the case since the telephone was introduced.

The Baxter 100,000 Watt Generator.

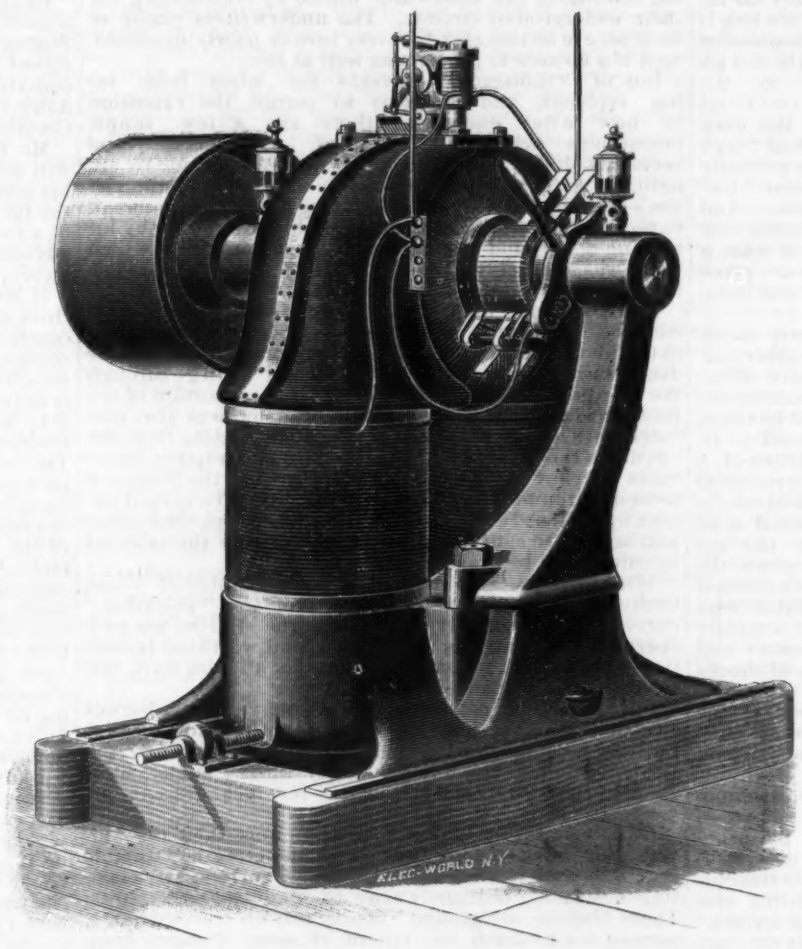
When the electric light companies commenced the business of supplying current to motors on their lighting circuits it was thought that the demand would be restricted to the smaller powers, say from one to five horse power; but the success of this method of power distribution has been so satisfactory to both the electric light companies and consumers that as time progresses there is a constantly increasing demand for larger units of power; as high in some cases as 75 and 100 horse-power; and some provision in the near future—as it is merely a question of a few years before the steam engines of the smaller manufactories will be supplanted by the electric motor—will have to be made to satisfy this demand for large powers.

The incandescent lighting companies are generally able to supply comparatively large units of power, from 20 to 40 horse-power, but it is claimed by some that to run motors and lamps together on an incandescent circuit is not a successful undertaking, due to the fluctuations in the light caused by the sudden increase and decrease in large amounts of the current with varying loads upon the motors. When the switch on an incandescent motor is closed to start the machine, there is an immediate increase in current in the mains, and consequent drop of potential at the terminals of all the lamps on the same feeders; and this unavoidably directly affects the brilliancy of the lights; and when the motor is in service the intensity of the light rises and falls in unison with increase and decrease in power developed by the motor. With small motors these fluctuations in the brilliancy of the lamps are not noticeable. This defect in the constant potential system can be overcome to a very considerable extent by increasing the size of the mains, but this means an additional outlay for wire, etc. From this it is claimed that to run large motors with the constant potential system successfully they must be placed on special circuits independent of the lights.

With the arc light systems the variations of the load thrown upon the motors produce no perceptible fluctuations in the lights, provided the generator is furnished with a sensitive regulator, as is the case with most prominent arc light machines. The disadvantage of the arc light system is, that with the weak current used in arc lighting, motors above ten horse-power cannot be run with advantage on these circuits, on account of the incapacity on the part of the generators. In order, therefore, to supply motors of large power with the constant current system, it is necessary to have stronger currents than those used in arc lighting.

It is evident from the above that with either the constant potential or constant current system supplying large powers, it is necessary to run independent motor circuits, and it becomes merely a question which is preferable.

With a great many of those having experience in the distribution of power, the constant current, it is claimed, is greatly preferred, since, compared with the constant potential system, the cost of mains is much less, the territory covered much greater, while the efficiency of distribution is much higher.



BAXTER GENERATOR FOR MOTOR CIRCUITS.

Although the Baxter Electric Manufacturing and Motor Company, of Baltimore, Md., builds motors for both incandescent and arc light circuits, they believe that the constant current is to be the system of distribution in the future. They have, therefore, commenced the manufacture of large generators to enable the electric light and power companies to furnish current to motors from one-quarter to 50 and more h. p., one of which, calculated to give about 133 electrical h. p. (100,000 watts), is illustrated in the accompanying engraving,

As will be seen, the field magnet coils are upright and joined together by a yoke of massive proportions, making a substantial base for the machine. The armature is of the Gramme ring type, built up of insulated charcoal iron discs, the shaft of which is supported in bearings attached solidly to the base. Seated on the top of the pole pieces is the device for maintaining the current constant. It consists essentially of an armature playing with a small angular movement between two field pieces, around which the whole current of the machine passes, with a connecting rod and rollers playing upon copper strips, connected with the terminals of the several layers of the field coil.

Variations of the current produce movements of the regulator armature, which cause the rollers to traverse the ends of the strips, thereby cutting out and weakening the field proportionately when the current is too strong, or throwing in additional parts of the field when the current falls below the value desired. This regulator is entirely automatic, and makes the machine absolutely self-regulating.

The machine shown is calculated to give 40 ampères at 2,500 volts potential, or 100,000 watts at 800 revolutions per minute of the armature. The resistance of the armature is 64 ohms; that of the field 70 ohms: and the energy absorbed in overcoming the internal resistance a trifle over 2 per cent. of the total output of the machine. The commercial efficiency is said to be between 93 and 94 per cent. This machine is calculated to supply from 230 to 270 horse-power of motors distributed on a circuit from 20 to 30 miles long.

It is the intention of the company to manufacture and place upon the market generators of double the capacity in the near future; and they have under consideration the installation of several plants for transmitting the power of large water falls, for which purpose very large machines will be required, motors as well as generators.

It looks, therefore, as if, before long, electric machines for power transmission will be in common use, of proportions vastly greater than those dreamed of by the most sanguine believers in the adaptability of electricity to the wants of the industrial world.

Detecting Leaks in Underground Conductors.

BY E. ALEX. SCOTT.

I have read with much interest the article published in THE ELECTRICAL WORLD of July 7th in which Mr. A. E. Kennelly describes the Edison method of detecting leaks in underground conductors. The method is extremely simple, and by its use the cable inspector can unerringly and with very little trouble locate a leak, even of quite high resistance.

It is not, however, a new thing, as it has been in daily practical use for the past year on the 14 miles of underground conductors of the Haverford Electric Light Company. When the Electro-Dynamic Company, of Philadelphia, first took charge of the Haverford Company's plant it had much trouble in locating grounds on about five miles of defective lead-covered cable. I then devised the compass method of testing for leaks, put it into practical use at once on that cable, and described it at the first fall meeting of the Electrical Section of the Franklin Institute.

As the accumulator batteries are used by the Haverford Company, a current of any desired voltage can be used in making the test, but in the majority of cases the 60 volt current of a single battery, and the current through one lamp, or less than one ampère, has been found sufficient, the opposite terminal of the battery being grounded through the lamp, and the circuit thus formed through the leak being broken at short intervals.

If the circuit be broken about once a second (instead of ten seconds as suggested by Mr. Kennelly) the compass needle, by getting an impulse at regular intervals, will get up a swinging motion with a very small current. Two grounds may occur simultaneously on the same section of a bad cable, and it is always advisable to test the line from either end, alternately, before moving the compass to a new point.

Mr. Kennelly will probably find, in practice, that it is essential to open the metallic covering of the conductor (which is an easy matter with lead covered cable) before making his test, as the current not only passes along this metallic sheath beyond the leak, but what is more important, it returns on the sheath toward the battery with nearly the same strength as the current in the conductor, and thus neutralizes the action of the needle; whereas, if the sheath be opened the result is certain, and nothing is left to conjecture.

Weston's New Alloys for Electric Conductors.

There are a great many electrical devices containing long lengths of conductor, usually in the form of coils or in convolutions, through which in the use or application of the instrument the current is passed, and in which it is desirable, and often extremely important, to preserve a constant resistance. This is frequently a matter of the greatest difficulty, inasmuch as a strong current is apt to raise the temperature of the conductor, which, with all metallic conductors heretofore used, operates to increase the resistance. In fact, the resistance of all such instruments varies with the temperature of the coils or conductors, to whatever cause such variation in temperature may be due. Among the instruments which are injuriously affected by this property of conductors may be mentioned rheostats, artificial resistances, regulators, electrical meters, indicators, or testing instruments generally which are connected with a circuit or branch thereof for determining the strength of a current or the potential at any point in the circuit It is evident that a remedy for this is extremely desirable, as it would add greatly to the value and efficiency of every instrument to which it is applied.

In seeking for a means of overcoming this difficulty Mr. Edward Weston has recently discovered two new alloys which accomplish the desired object.

He has discovered, in the first place, that the metal manganese imparts a very high electrical resistance, and, in fact, a higher specific electrical resistance than can be obtained by the addition of any other metal, to alloys, into which it enters as a constituent; and, second, that the addition of the manganese has the further remarkable property of rendering the electrical resistance of such alloys nearly or quite constant under varying conditions of temperature.

Thus an alloy of manganese with copper produces a conductor having the above characteristics. This alloy is made by the common process of melting the two metals; but in practice Mr. Weston employs ferro-manganese on account of its greater cheapness, and this he mixes in the proportions of copper, seventy parts; ferro-manganese, thirty parts, or thereabout. This alloy is capable of being rolled and drawn, and is made up into wire in the usual way.

The exact proportion of the metals used may vary somewhat; but while Mr. Weston has found that the addition of manganese or ferro-manganese in any proportion to copper is an advantage, so far as preserving a constant resistance is concerned, he finds that the best results are obtained by the use of the proportion given above.

Mr. Weston has also discovered an alloy the resistance of which is lowered by an increase in temperature, a property heretofore lacking in metallic conductors. This alloy, the resistance of which lowers with increase of temperature, is composed of copper, manganese or ferro-manganese and nickel. This may be used for one portion of a coil and copper or German silver for the other, so that should the coil be heated by a current, or otherwise, the changes of resistance in the two portions of the coil will neutralize each other. To secure an exact balance is a matter easily determined by adjustment of the lengths of the two portions of the coil, or by the relative proportions of the metals used in the alloy.

Mr. Weston employs with German silver or copper an alloy containing from sixty-five to seventy parts of copper, twenty-five to thirty parts of ferro-manganese, and two and one-half to ten parts of nickel.

Telegraphy in Persia.—Mr. Thomas Stevens, the world bicyclist, gives an interesting account of the telegraph lines running across Persia, and says: "The Ingiliz telegraph-jee is quite an important personage in Persia. Outside of Teheran and Bushire, he is the sole representative of Europe. He is a sahib, whose salary often exceeds the income of the Persian prince or governor of the town. He has several servants, and keeps the showiest riding horse in town, vying in the matter of horseflesh with the local prince, with whom he is always on very good terms. He and the prince invite each other to dinner; not a day passes but the prince comes and smokes a kalian or two in the telegraph thana, and in the evening they sit beside the steaming samovar and smoke and drink tea. The prince sends his friend, the telegraph-jee, presents of fruit, or a pheasant now and then, and when the line inspector comes along and leaves with the Englishman a few bottles of choice cruiskeen lawn the prince knows he will not be overlooked."

The Admission of Alternating Currents into New York City.

At the meeting of the Board of Electrical Control on June 8, Commissioner Gibbens read the following letter which appeared in the *Evening Post*, signed by Harold P. Brown, "electrical engineer," 201 West Forty-fourth street, New York:

To the Editor of the Evening Post:

SIR: The death of the poor boy Streiffer, who touched a straggling telegraph wire on East Broadway on April 15, and was instantly killed, is closely followed by the death of Mr. Witte in front of 200 Bowery and of William Murray at 616 Broadway on May 11, and any day may add new victims to the list. After every such accident the newspapers clamor to have the wires placed underground, while the electricians connected with the system at fault hold their peace or throw the blame on the telephone wires, until the matter has been forgotten. As an electrical engineer I know that burying the wires would not remedy the trouble, though it would largely diminish the risk, while the enforcement of a few common-sense regulations would make it almost impossible to kill a man from an arc light current. It will not do for electricians to state that they "don't know what killed that man," for unless they take prompt measures to make their business safe some terrible accident will cause the adoption of laws to regulate electric lighting, which, being framed by their enemies, will cripple or destroy their business.

So at the risk of offending some corporations having heavy investments in unsafe systems, I will venture to state a few facts which I trust the press will be kind enough to publish widely, as no disinterested electrician will deny my statements.

It is well known that a continuous current of "low tension," such as is used by the Edison Company for incandescent lights, is perfectly safe as far as life risk is concerned. From this fact the false popular impression has arisen that all incandescent systems are safe and all arc systems dangerous. But it is not to the "low tension" alone that this current owes its safety, since a factor fully as important is the even steady quality of its delivery. That is, a current of "high tension," but unbroken and continuous, *may* be perfectly safe if properly operated, while a current of lower "tension," but wavy or pulsating, is *always* dangerous. And when these pulsations rise in speed and intensity the danger increases, until the climax is reached in what is called "alternating current," in which impulses are given first in one direction and then in the other several thousand times a minute.

To understand the reason for this it is necessary to remember that when a current through a wire or other conductor is made or broken, a current in the opposite direction is "induced" in any parallel conductor; the same effects are produced in a less degree when the first current pulsates, but are intensified when it is alternated or reversed in direction. Any one who has held the metal handles of a "medical" (galvano-faradic) battery, has had a practical experience of the power of induction and pulsation; in this apparatus the current from the battery itself is so feeble that it cannot be detected without the use of instruments, except by the metallic taste when the terminals are touched by the tongue. This insignificant current is passed through a short piece of insulated wire coiled around an iron core, and is interrupted by a rapidly vibrating armature, thereby inducing in another and longer coil of wire surrounding the first a series of shocks whose intensity can produce most intense suffering or even death in a human being who forms a portion of the circuit. It is this rapid succession of shocks that kills, while a single steady impulse of the same intensity would do little damage.

Two of the leading arc-lighting systems have dynamo-electric generators provided with what are known as "open-circuit armatures," which produce a pulsating current somewhat similar in kind to the one just described, though a thousand times more powerful. It is to this current that nearly all the deaths caused by arc-lighting systems must be attributed. These "open-circuit armature" systems were pioneers in electric lighting, and at the time they were invented it was supposed that the "closed-circuit armatures," which produce the steady and safer current, could not be made to develop sufficient electromotive force to operate a number of arc lamps upon one circuit. But the recent advances in the science have made possible "closed-circuit armature" generators which give the same amount of current and electromotive force, with a much less expenditure of motive power, so that there is now no valid reason for the existence of the old type with its pulsating and dangerous current.

I do not mean to have it understood that the "steady" current is always safe or that the "pulsating" is always unsafe, for any current with more than fifty arc lamps in series is dangerous and should be prohibited; while the "pulsating" current, if its circuit is kept thoroughly insulated and carefully watched, and tested every day, may run for years without a fatal accident. But the fact remains that the "steady" current, with fifty or less lamps in circuit, has had, to my knowledge, but four victims against the scores killed and maimed by the "pulsating" current. And even these four were responsible for their fate, since all were employés and should have known better. Three of them tried to disconnect apparatus through which they knew the current was flowing, and thus got into the circuit, while the fourth received the full current while trying to repair a broken wire which he knew was charged.

But the persons killed by the other system, as a general thing, have been in no way responsible for the accidents that caused their deaths; they have, as did young Streiffer, touched or run against an apparently harmless wire when standing on a damp place, or have touched at the same moment some metal accidentally charged with the fatal current and some other conductor having a "ground" connection, as did Mr. Witte. I do not believe with extremists that the "pulsating" current should be prohibited, but I do think that the conditions of safety should be rigidly enforced by the authorities.

If the circuit carrying the "pulsating" current is perfectly insulated at all times, no accident is likely to occur. But if, through wearing of the insulation, or a heavy rain, a connection between the circuit wire and the "ground" is formed, any one who touches the wire and a "ground" will receive a portion of the current; if he happens to be near the other "ground," he receives but a small shock, but if there are a number of lamps between him and the other connection, the shock may be fatal.

Of course the reply will be made that all the arc-lighting stations in this country use insulated wire, "as required by the underwriters," but here is just where a great mistake has been made, and the sooner this is corrected the better for the cause of electric lighting. It is an open secret among electricians that the wire known as "underwriter's wire" has a very poor insulation, even when new and during dry weather, but practically no insulation at all during a rain. The paint dries out of it after a few months' exposure, other wires rubbing against it soon wear away the cotton and expose the metal, and it is altogether unfitted for outdoor use. Among electric-lighting men it is appropriately called "undertaker's wire," and the frequent fatalities it causes justify the name.

Even with the most conscientious electric light superintendent, who tests his circuit carefully for "grounds" every day, before starting the generators, there is no surety that during the run some telegraph wire may not drop upon his circuits, wear away the insulation, and set a death-trap for the unwary who may be miles away from an electric lamp.

The condition of the electric light circuits in the lower part of the city is simply disgraceful, as has been previously pointed out. Most of them were first put up years ago; they have been cut and patched until full of joints, from which the tape flutters; the insulation is entirely worn off in places or hangs in shreds, and few circuits are fit to run with safety for a single hour. They cross and recross the structures of the elevated roads; they sag and sway in loose loops, and are intersected at all levels by telephone and telegraph wires. On some of these circuits two or more dynamos are run in series, thus more than doubling the life risk, and it is almost certain that it was these overloaded circuits that killed Streiffer and Witte.

If the Board of Electrical Control cannot force the wires underground, they can at least condemn these lines, which the companies can afterwards utilize by reinsulating for their underground circuits. The underwriters ought to have an eye to this also, for every bare or poorly insulated spot is a menace to property as well as life.

But if "influence" prevents the wires from being replaced, and it seems to permit the extension of new wires elsewhere, there are a few simple precautions which, if enforced, will make fatal accidents almost impossible. All the deaths due to arc lighting, as far as reported, have been caused by the victim's breaking the circuit and placing himself in the break to receive the fatal "extra current" thus caused, or by his making a "ground" connection with a circuit on which there was another "ground." Both of these dangers can be avoided by very simple apparatus.

If a voltameter, or a circuit of very high resistance, be connected across the poles of every arc-light dynamo, the external circuit may be opened without producing the death-flash, as most of the "extra current" will go through the by-pass. This would prevent a large proportion of the fatal accidents. If every arc-light dynamo was also provided with a wire of very high resistance leading from the circuit to the "ground," upon which was interposed apparatus to shut off the production of current the instant a second "ground" occurred, no deaths could be caused except by foolhardy carelessness. The latter apparatus could also be used to shut down the current in case the external circuit should be broken.

With these precautions, and with the number of lamps limited to fifty on a single circuit, even the "pulsating" current would be fairly safe, but as the stations are now operated upon circuits with frayed and worthless insulation, they are a constant menace to all who walk the streets, use a telephone, or touch a wire.

In regard to the popular impression that all incandescent electric lighting systems are safe, I am sorry to say that recently several companies who have more regard for the almighty dollar than for the safety of the public, have adopted the "alternating" current for incandescent service.

If the "pulsating" current is dangerous, then the "alternating" can be described by no adjective less forcible than *damnable*. With the "pulsating" current three contingencies must ordinarily arise to produce fatal results: There must be a "ground" connection on the circuit; a person must touch the circuit at some distance from the first "ground," and must at the same instant be in connection with the "ground" himself. But the "alternating" current produces fatal results by simply touching the two parallel wires, always close together, connections from which enter every house. Its supporters may say that on account of its danger they do not permit the "primary" or death current to enter the house, but supply the lamps from the "secondary" current. True, but between these two circuits is interposed nothing more than a thin layer of cotton or silk insulation, and, as has happened again and again, it requires but a flash of lightning or a little moisture in the converting apparatus to bring the death-current to each lamp.

The only excuse for the use of the fatal "alternating" current is that it saves the company operating it from spending a larger sum of money for the heavier copper wires, which are required by the safe incandescent systems. That is, the public must submit to *constant danger from sudden death* in order that a corporation may pay a *little larger dividend*. I do not know of a single disinterested electrician of high standing who does not condemn the alternating system. Siemens & Halske, a firm of electricians with a world-wide reputation, have spent years of experiment upon it, but have abandoned it as unsafe, and say that its use should be prohibited by law.

Following the example of Chicago, the Board of Electrical Control should forbid the use of the fatal alternating current, and legislatures, city councils, and life-insurance managers should see to it that stringent laws and regulations be passed to prevent this wholesale risk of human life. The placing the wires of the alternating system underground would only intensify the danger in houses where it might be used, while its use with underwriter's wire in a city like this is as dangerous as a burning candle in a powder factory. If the death of these three men can effect the adoption and enforcement of regulations similar to the following, they will not have died in vain.

RULES FOR STATION LIGHTING.

Not more than fifty arc lights shall be operated upon any one circuit, unless said circuit is used exclusively for street lamps mounted upon wooden poles; in this case the number must not exceed sixty.

All outdoor arc-light circuits must be provided with waterproof covering having an insulation resistance of not less than one-half a megohm. Any circuit falling below this must not be used until restored.

No arc-light dynamo shall be operated unless provided with a voltameter across its terminals, or other device, to provide a path for the extra current caused by opening the external circuit.

No arc-light dynamo shall be operated unless provided with means for automatically stopping the production of current the instant a ground connection is made upon its circuit.

No arc-light dynamo shall be operated unless provided with means for automatically breaking or short-circuiting the field circuit the instant the external circuit is broken, in order to prevent a current from being built up by the broken circuit ends falling upon some conductor.

No alternating current with a higher electromotive force than three hundred volts shall be used.

HAROLD P. BROWN, Electrical Engineer.

In order to give an opportunity of replying to the letter, invitations were extended to the various electric lighting companies interested, and a day appointed for the hearing of arguments as to the necessity of adopting the rules proposed by Mr. Brown, which would practically shut out alternating currents from the city. The meeting was postponed from time to time on account of the death of the daughter of Secretary Moss of the Board of Electrical Control, and was finally held in the lobby of Wallack's Theatre, on July 16. Upon the calling of the meeting to order, Commissioner Gibbens announced that the Board was ready to listen to all who were interested in the subject. Communications were then read before the meeting as follows: T. Carpenter Smith, S. C. Peck, M. M. M. Slattery, R. W. Pope, Prof. H. Morton, O. B. Shallenberger, H. M. Byllesby, W. H. Browne, S. G. Smith.

PHILADELPHIA, Pa., July 12, 1888.

WM. H. BROWNE, Esq., New York City, N. Y.

DEAR SIR: Your favor of the 9th at hand, in which my attention is called to an article in the New York *Evening Post* of June 5th, 1888, headed "Death in the Wires," signed by Mr. Harold P. Brown, electrical engineer, which contains some very sweeping assertions, and also lays down the law in a manner to which I am sure no practical electrical engineer would commit himself.

Mr. Brown's statement that no disinterested electrician will deny his statements I think is very correct. Some of his statements are hardly worth denying, and it is only the fact that they are apparently published in the interests of a particular corporation, and for the purpose of taking advantage of the fears of an uninitiated and justly anxious public, that makes it worth while to answer any of them.

If Mr. Brown had confined himself to showing that the three deaths he quotes were all caused by neglect of the commonest precautions, he would have done far better service than by entering into a quasi-scientific disquisition which the general public cannot understand, and which is so full of absurdities as to show that he has either the little knowledge which is so dangerous a thing, or it is a deliberate attempt to make a good case by false inferences. The one point plain in his article is that the system of one particular company is perfectly safe and all others are dangerous, and that one in particular should be wiped out of existence. One of the deaths which Mr. Brown cites, that of Mr. Witte, was reported as caused by a "closed circuit" "shunt-wound" machine, the very one which he calls the "steady current," which has only four victims against the scores killed and maimed by the pulsating current, "the fact being that the pulsating current" has tens of thousands of arc lamps where his much boasted "steady current" has thousands. It is as though he had claimed that only four men had been killed while traveling on horseback in New York City, while scores had been killed on the elevated roads; therefore it is safer to ride horseback than by railroad.

I have been running electric lights, both arc and incandescent, for the past seven years, and have never known of a case where it was conclusively proved that a man was killed by the electric current, without there having been gross carelessness in some direction. Mr. Brown could very easily have accounted for every death that has occurred in New York (as far as I have been able to follow them) by the condition of the wires alone. Any man who would undertake to run belts carrying thousands of horse-power, even in a factory where none but skilled help are employed, in the unprotected way in which wires are run overhead in New York City, would be universally condemned. I never walk in the streets of New York but my blood boils to see the criminally dangerous and reckless manner in which wires are strung through the streets. They are placed, not on poles, but on stumps, and wood exposed to the weather seems to be a good insulator. The so-called underwriters' wire covering seems to have been originally the standard, and even that is worn off in many places for several feet along the wires, while the whole air is full of dead and rotten telegraph, telephone, burglar alarm and district call wires, any one of which by falling across an arc light circuit becomes itself as dangerous. It is an absurdity for Mr. Brown to talk about lighting stations and "simple rules and precautions" to be enforced therein. No precautions at the station, however valuable they may be in themselves, can render electric lighting safe, when the outside circuits are in this condition.

It is this outragous and inexcusable carelessness which has led to the cry for "underground wires," a cry that has so much real foundation that we may well excuse the often rabid insistence of its utterers. The fact that the wires are in this condition in the largest city in the country is taken as a proof that they are in a similar condition in every city and cannot be made safe, and paper after paper reiterates the senseless shriek against the horrible danger of overhead conductors without any reference to the manner in which they may be installed. An overhead wire with properly soldered joints and water-proof insulation, with insulated tie wires and kept clear from all ground contacts on buildings and trees and out of reach from the ground, is as safe as any underground conductor that can be made, except in case of damage caused by fire, storms or external violence, in which cases the underground conductor has such an overwhelming advantage that this plea alone should be sufficient to cause them to go underground.

I am an earnest advocate of underground wires and an interested one, but the claim that wires are dangerous simply because they are overhead will only hurt the cause, for that reduces it to the level of the outcry against the introduction of railroads, or gas, or any new improvement. There are enough fair arguments against overhead wires without resorting to claptrap or trickery. If Mr. Brown kept himself posted as any one who wishes to pose as a

general electrical teacher should certainly do, he might have noticed a report in one of the electrical papers of a painter who fell from the roof of a building in Pittsburgh, and who saved his life by catching hold of the two opposite leads of an overhead circuit carrying one thousand volts of alternating current, by which he hung until taken down unhurt, with a ladder. This is what I call good practice in overhead construction. High insulation and good solid work that your wires can stand the strain of a man falling 20 feet on to them without tearing them loose.

Now for Mr. Brown's attack on which he has been pleased to call the "damnable alternating current." He evidently has not had the least experience with the alternating current as applied to electric lighting, and his information seems to have been derived chiefly from a gratuitously circulated publication of the corporation, the sale of whose particular apparatus is most affected by the alternating system.

In spite of all that has been said on this subject in the past year at the various electrical conventions, in spite of the published descriptions of the various converters manufactured by different companies, without taking the trouble to inform himself by actual inspection of a single converter, he again repeats the statement that I can characterize as nothing but the grossest ignorance of electrical manufacture, or a deliberate falsehood, that between the two circuits in a converter is interposed nothing more than a thin layer of cotton or silk insulation; and he says "that has happened again and again, it requires but a flash or a little moisture in the converting apparatus to bring the 'death current' to each lamp," showing his utter ignorance of the whole subject, not to know that in the first place only the lamps of one group would be affected by being extinguished, for in such cases the safety fuses would instantly melt and cut off the current. A more contemptible evasion of the real question at issue I have never seen than his reference to Messrs. Siemens & Halske, as opponents of the alternating systems. Messrs. Siemens & Halske abandoned the manufacture of alternating current apparatus for the same reason that Westinghouse abandoned their apparatus after having tried it, namely, because they could not make commercially efficient apparatus which would not overheat and burn up, and the fact is that Siemens & Halske are to-day making and selling the underground cables for alternating current work in Europe. These cables have one conductor in the centre surrounded by an insulating material; the outer conductor is wound on the outside of this with a layer of insulating material, and the whole is then covered with a sheathing of steel tape, and Messrs. Siemens & Halske recommend and guarantee these cables for use with an alternating current of (5,000) five thousand volts. He says that he does not know of a single disinterested electrician of high standing who does not condemn the alternating current system. His acquaintance with eminent electricians must be limited. Why did the Edison company secure the control of the Zipernowski system as soon as the Westinghouse had made a market for the alternating current in this country? Why did the United States company secure the Jablochkoff system for the same purpose? Are not Ferranti, E. J. Houston, Elihu Thomson, men of high standing? Truly these men are all interested, but who are disinterested electricians nowadays? Prof. Forbes, of England, is usually referred to as probably one of the best posted men, and the most thoroughly disinterested electrician of the day, and I, myself, heard him say at the electric light convention, held in Pittsburgh last February, that the alternating system, as installed in America, made him feel that we were far ahead of anything they had done in England, and that he had completely changed his opinion, and was now satisfied that the alternating system was safer than any direct current of the same tension could be. For people who have absolutely no experience with electric lighting by alternate currents to refer to speeches made five years ago by electricians, however eminent, is folly when we recall the history of the alternating system in this country. First, it was an impossibility. Then this was limited to its being a commercial impossibility, and when its adoption showed it was a success, every pettifogging self-styled electrician, who had been engaged in proving it ridiculous, turned his attention to proving that it was old and that everybody knew about it years ago, and the very companies, who had been ridiculing it, both publicly and privately, turned their attention to foisting on the public the most unblushing and slavish imitations of the successful form of this apparatus, and which has excited the unqualified admiration of European electricians.

Now the fact is that it has been proved in a dozen cases that the alternating current, while disagreeable, is far less dangerous to life than a direct current of the same tension. Personally I have received the full 1000 volt current from an alternating current machine, not once but half a dozen times, and I have received the direct current in the same way, and, while the direct current will always make one sick for some time after the shock, the alternating current leaves no such effects. I have seen five or six men get this 1,000 volt alternating current shock direct from the machines. I have pulled one off who was hanging to the bare switch-board wires and whose hands were badly burned, but who in half an hour was at work again, having in the meantime walked by himself to a doctor to have his burns dressed. Add to this that this high tension current is thoroughly insulated and protected from the house circuits by layer after layer of insulating tape, mica, fibre, and by a open air space, and one can easily see that the danger of high tension reaching the house is very remote indeed.

Mr. Brown has chosen to exhibit his ignorance and bias by speaking of the lightning bringing the high tension into the house; that is to say, the lightning to enter any one house by the alternate current wires has to break down the whole insulation of the converter, while the direct metallic connection on the system which Mr. Brown is pleased to favor brings the lightning itself, with its tens of thousands of volts, direct to every lamp on the system, without the slightest check or hindrance. Yet how many people have been killed by lightning coming in on such wires? No one that I have ever heard of; and Mr. Brown knows that this danger is infinitesimal, or he is merely truckling to the prejudice in favor of direct current systems when he makes any such statement.

He spoke of the Chicago Board having forbidden the use of the "fatal alternating current." I presume he means the same board whose inspector read a paper before the Chicago Electric Club, in which he showed the induced discharge from a single magnet as an instance of an alternating current. They will simply have to abandon this position. Would it not be a good deal more sensible to follow the example of the Philadelphia Board which has simply placed the very strictest regulations (and what is a different thing, enforces them) as to the use of not merely alternating current apparatus, but of all apparatus, and came to this conclusion after a thorough inspection and test of the insulation and general construction of the alternating current system converters?

When Mr. Brown styles himself an "electrical engineer" he lays himself open to the pertinent inquiry: What has been his experience? What was his education on this subject? With what companies has he been engaged? What work has he done to which he can point with pride as a specimen of careful work? Is not this the same Mr. Brown, of the "Brown converter," who endeavored strenuously for two or three years to convince the various arc light companies of the country that it would be a great benefit to the public at large, and to their dividends (for which he now expresses such a lordly contempt) to carry a 3,000 volt current for incandescent lighting into houses and stores by means of an apparatus of his own devising, and which was designed to occupy the very field now taken by the alternating current system?

It is curious that he should apply to the alternating current system the very expression which was applied to it by one of the salesmen who was trying to induce me to adopt the "Brown converter" for house lighting on arc circuits, that "this damnable alternating current system was just wiping out apparatus like theirs all over the country." Can it be possible that a distinguished electrical engineer like Mr. Brown could allow himself to be be swayed by any such trifle as this? Let us trust not.

Yours truly, T. CARPENTER SMITH.

To the Honorable Board of Electrical Control.

GENTLEMEN: In the New York *Evening Post* of June 5 there appeared an article by one Harold P. Brown, electrical engineer, upon the dangers to be expected from electric lighting apparatus. This I have read, and carefully noted his suggestions to your Board regarding certain precautions which he claims should be observed. It appears to me that the article is hardly written in a fair spirit, and that many of the comparisons are obviously unjust and incorrect, and the suggestions impracticable.

In the first place the current from open coil armatures is referred to as "pulsating" and "death dealing," and is described as being much more fatal to human life than the current from a dynamo having a closed coil armature. It seems to me that this is purely and simply a matter of conjecture on the part of Mr. Brown.

I have tried many times to distinguish between the physiological effects of this so-called pulsating current and those caused from a closed armature. I have used in all cases sufficient resistance in the main line to give a difference of potential of from 60 to 200 volts. The sensation experienced in each case is precisely the same, as indeed is the effect upon the needle of a delicate galvanometer, which will stand perfectly still when under the influence of a current of either character from a properly constructed machine. There is no doubt but a voltage of 2,500 *would* fatally injure any person introduced into the circuit, but the idea that the effect of the open coil armature current would be many times that of the closed coil would be merely guess work, for I do not consider we have any reliable data to work from.

Assuming that there have been more unfortunate accidents upon circuits operated by dynamos of the open coil class, what do they prove? It is well known that these dynamos carry more lights and, consequently, a higher potential than the other style, and who can say that Mr. A. and Mr. B. would have lived had a shock of the same voltage come from a dynamo of another type? One thing is certain, viz, that there have been fewer fatalities resulting from the electrical current than from steam or other motive power. It is stated that but five men have been killed in New York during the past ten years.

Mr. Brown compares the alternating current as produced by dynamos with that emanating from what is generally known as the medical coil. He, as an electrical engineer, should know that they are in no manner similar except that they both are bi-direction currents. In the first place the current of the ordinary medical coil, capable of throwing a spark one-sixteenth of an inch in length, is immensely greater in pressure than that of the 1,000 volt generators now in use, which are incapable of striking through an air space of even one-hundredth of an inch; and, again, the current of a medical coil is produced by a direct current being made and broken, inducing currents of tremendous pressure, but of little volume, in the secondary. The unpleasant feeling caused by this current is directly traceable to what is known as the extra current, caused by the rapid changes in quality of the magnetization of a core of iron upon which the coil is wound, as well as the self-inductive effect of the coil itself.

With the alternating current the case is materially changed. A very small amount of wire is revolved in the field of force, which is absolutely constant and is not affected in the least by changes in the external circuit. The amount of potential is predetermined and controlable. There is no self-induction of any moment to produce the dreaded extra current, and opening the circuit and introducing one's self into it merely subjects one to the pressure of 1,000 volts, which has never yet proved fatal. There is no extra current and no kick from the field magnets.

But in supplying incandescent lights from alternating current circuits, it is not customary, for many reasons, to introduce the high pressure wires into the interior of the buildings. Between the primary circuit and the house circuit a transformer is interposed which effectually changes the character of the current from one of 1,000 volts pressure to one operating but 50 volts.

Mr. Brown states that there is but a thin film of cotton or silk between the primary and secondary windings of the transformer, and that this is liable at any time to be ruptured by a flash of lightning. This shows that he is totally ignorant of the construction of alternating current apparatus as well as the method of installation adopted by the leading persons in the business.

I am familiar with the various methods of protection used and have no hesitation in stating that when such as I shall describe, which have been adopted by the Thomson-Houston Electric Company, are carried out, there is no possibility of a high potential affecting persons through any accidental contact with the secondary wires. In the first place this company operates its dynamos at a potential of but 1,000 volts, as against 1,800 or 2,500 used, and, so far, with safety for the past two years in many places abroad. For every installation of transformers a lightning arrester is used which is absolute in its action and effectually prevents any ill-effects to the transformer from a lightning stroke upon the line. I have never known one to fail yet. Then the primary winding is separated from the secondary by a very substantial septum of insulating material thoroughly dried and shellacked, and finally, the secondary or interior circuit is soundly connected to the earth. Where is there any danger now? Even if the high potential were to get upon the secondary line, what possible harm could be done? Suppose the primary line in a first class condition and the secondary properly grounded as described; also the accidental contact upon the primary and secondary. A person touching the secondary, and at the same time making contact with earth, would be affected in what manner? Not at all. Why? Because there is no complete circuit. But go further and suppose a ground upon the primary as well. A person touches the secondary and again there is no effect. Why? Because there is a complete shunt about his body caused by the earth and the ground connections; and even if the transformer were not instantly cut out of the circuit by the fusing of the plugs, all the current would go by a shunt which is of no resistance and would not influence the man at all. Why should Mr. Brown be so set against the high tension alternate current when it has been in successful operation for so long a time and which even under the worst conditions could but introduce a potential of 1000 volts upon a few lamps at a time? It is not consistent, because we find about a year ago a description of "the Brown automatic converter," a modification of a device to be used in running incandescent lights from arc current circuits "without involving a large expense for incandescent lighting plants, or the necessity of getting a large number of subscribers to commence with and also valuable to incandescent lighting companies for customers too distant for the ordinary incandescent circuits."

Why are no charges made here against incandescent circuits which must be considered extraordinary? Surely no man, so careful for the safety of a general public, would advise the use of such an arrangement, which is liable at any time to bring a difference of potential of 3,000 volts into a man's house, and this pressure, too, of a dynamo producing a "deadly pulsating" current, for we read in the advertisement in capitals, "can be used with any make of arc light dynamo." To say the least it looks very curious, and one is inclined to read between the lines when noting an "electrical engineer" stand forth in condemnation of the one successful commercial method of introducing the electric incandescent light, and stating that the use of 300 volts of alternating current is dangerous, but implying that the operation of incandescent lights upon 3,000 volt current circuits is not to be condemned when in conjunction with the "converter."

Let us take up his letter again and turn to the suggestions.

In order to discover the presence of grounds upon the line he advises the use of a permanent ground connection at the station. Inquire among station superintendents and see how many of them agree with him. In order to keep a line in condition we are told to subject it to a constant strain at every insulator and contact point. Is this wiser than the present method pursued by all properly governed companies, viz., to test the circuits every day and to keep them free from grounds? Also to shut down should any vicious connection occur during the night? There is a station in this city which is constructed on sound principles. The wires are well insulated and well run and there has not been a ground on a circuit for weeks.

Again we are told that to prevent the flow of the extra current through the body of a person introduced into the circuit, we are to place a voltameter or high resistance across the dynamo terminals. Very well; do so and what will you have? Evidently the resistance must be high in order that too much current may not be going to waste; now, will not the "death stroke" divide itself according to the law of shunts and will not the person get a good share? If the resistance were constructed as a coil I am not sure but its effects would be practically useless and until it is definitely known whether it is the prime potential or the after current which kills, we had better pay more attention to the exterior lines and construction and less to such traps.

And again we are to provide a means for automatically shunting the fields when the external circuit is opened. There is more merit in this than in the other schemes, but I do not believe any device could be made sufficiently sensitive to operate in time to prevent any person opening the circuit, and at the same time not to interfere at improper moments. As there are so many simple and effective methods for determining when the circuit is broken, it does not seem wise to make any such law.

The reference to Siemens & Halske is not bad. It has been published in several papers in New York and Boston and always in the same words. Investigation shows that the company referred to never did make a business of manufacturing alternating apparatus other than a dynamo which is to-day made by them and for sale in Europe. Perhaps the reasons they did not manufacture can be found in the records of the patent office, or it may be Rankin Kennedy's articles on alternating current apparatus would prove of assistance to those desiring a partial idea of the true state of affairs abroad. The position of Chicago and its inspector is well-known.

We read last that the "damnable" alternating current should not be permitted in higher voltage than 300, and that if the proposed rules are adopted, three men shall not have died in vain. It can only be said that most of the rules, as well as the letter, show under a philanthropic exterior a distinct bias; which, perhaps, may be accounted for when we recall Mr. Brown's connection with the American Company, whose dynamo has a closed coil armature. It would be interesting to read the opinions expressed by Mr. Brown when he was engaged in installing the plant of the Brush open coil system in Eau Claire, Wis.

A summary of Mr. Brown's paper may be made as follows:

First—The alleged comparison between the effects from a medical or galvano-fardic coil and the alternating current dynamo does not exist.

Second—The death-dealing quality of the current from dynamos having open coil armatures is but conjecture.

Third—Placing a shunt of high resistance about the terminals of the dynamo is impracticable and would but partially compensate for the after or extra current.

Fourth—It is not clear that death is caused by the after-current or "kick" of the machine. In fact, it is probable that such extra current is not essential from the fact that

fatality has occurred from simple connection with a grounded wire.

Fifth—A constant ground on a high tension dynamo in order to detect a second one is poor engineering.

Sixth—A break in the circuit would be indicated by the performance of the apparatus in the station, and the one in charge should shut down without any further notice from a complicated device which might render steady commercial service questionable.

Seventh—Under no circumstances should 300 volts be made the limit allowed alternating current service, because practical demonstration extending over a period of two years shows that where the proper protecting devices are used there is no danger.

In conclusion, the writer must suggest that in the action already taken by your board regarding overhead construction is to be found the solution of the danger question.

Of course, the electric current under certain conditions is dangerous, but no more so than steam plants or various forms of motive power. What is needed is *control* and not *prohibition*. Look over the lines last constructed in your city, and note that any danger from them must be preceded by some accident not practicable to the installation or operation of the plant. A stone upon a rail may wreck a train. A boiler under 150 pounds steam is subjected to greater strain than one with 50 pounds, but by strengthening the construction we keep the steam in. Follow rule No. 2 suggested by Mr. Brown, and let us use better insulated wire. Whether it be Cowles or Simplex, Trinidad or Bishop's makes little difference, but keep up the standard. The extra first cost of an installation even with the most expensive wire will not average more than five per cent. on the total investment, while the percentage improvement in dividend paying quality is not to be estimated. Respectfully submitted,

NEW YORK, July 12, 1888. S. C. PECK.

FORT WAYNE "JENNEY" ELECTRIC LIGHT CO.,
FORT WAYNE, Ind., June 29, 1888.

To the Honorable Board of Electrical Control, New York City, N. Y.:

GENTLEMEN: The question of the danger of alternating currents in the present systems of lighting by incandescent lamps has been in the past a much-discussed one, both at the meetings of the National Electric Light Association as well as at the meetings of various scientific societies through the country, and the conclusions arrived at by those who are theoretically and practically competent to judge are that the alternating current is not dangerous by any means when used within certain limits of pressure, and that the safety limit approximates 1,100 volts electromotive force. After an extended practical experience of three years by those who have carefully followed the alternating systems in use and after many physiological experiments, frequently involuntary ones, to determine the safe limit of pressure to work with, it has been found that no fatality can occur, or serious inconvenience result, from a shock from an alternating current having a pressure of that already cited, 1,100 volts. It has been long and well known that in most cases where fatal accidents have happened with high tension continuous current systems the death shock is received at the moment of breaking away from the circuit, not at the moment of completing the circuit around the body. The reason is obvious and twofold, viz.: When you place yourself in a circuit in which there is flowing a current at a dangerous pressure, the skin of the body, which has a very poor conductivity, in fact has good insulating properties, partly protects you from the dangerous shock; but as you will involuntarily make a desperate attempt to throw yourself out of circuit and succeed, at the moment of breaking away an arc will be set up, burning the body insulation (the skin), and, freely entering the trunk, will cause paralysis of the respiratory organs, preventing thereby the blood from being oxidized. Death will then ensue unless instant remedies be applied; and right in the latter line recently in France the passage of an alternating current through the body has been very efficacious in restoring life. The other reason of the fatality referred to is: At the moment of breaking circuit, an electromotive force far higher than was normally in the circuit is developed, considerably aggravating the effect of the shock.

In an alternating current of the same dangerous pressure there will always be a much better chance of escaping a fatality than in the case just quoted, as, in the first place, the electrical impulses being equal and opposite, the effect of the normal electromotive force a one will be experienced. For, at the moment of breaking away from the circuit, when the pressure would have a tendency to rise, an impulse in the opposite direction will instantly neutralize it and the E. M. F. is maintained normal. Again the very nature of the current with the impulses equal and opposite also tends to suppress the arc at the moment of breaking, for the same reason as that which tends to maintain the E. M. F. normal, preventing the skin from being so badly burnt, and the current proportionately from free and dangerous passage to the vital organs.

The danger attending the use of converters has been referred to, chiefly, however, by those not familiar with their construction. We will admit for the sake of argument that we have exceeded the safe limit of pressure in the converter, and let us see whether the dangerous current will, or will not, reach the users of the incandescent lamps.

I will premise what I shall say at this point by stating, and I have occasion to say so elsewhere, that two-thirds of the difficulty is overcome when you understand its nature. Now in this case we want to prevent the dangerous current reaching the users of lamps: we know the current is dangerous, our practical experience has so informed us. The secondary coil, in the circuit of which the incandescent lamps are placed, is in the same iron receptacle as the dangerous primary coil which is connected with the primary circuit and by the entrance of moisture of a discharge of lightning the organic insulation between the two coils might very readily give way, as it occasionally did in the earlier experimental stages of the work years ago. We should not, however, trust to any insulation to keep the current in the respective coils; in this case we simply introduce a conducting strip of copper or other metal between the primary and secondary coils in the box containing the converter; this strip being carefully insulated from both primary and secondary coils, may be seen in the converter submitted for inspection.

Now what is the effect of the dangerous primary current endeavoring to reach the secondary coil and circuit? It will be obvious that it will be intercepted by the interposed metallic strip referred to and the current which might enter the secondary is diverted to a ground connection made with this strip. Should a lightning discharge enter the primary it will surely go to ground, for which it has in all cases an affinity—seeking the passage of lowest resistance. Should a lightning discharge strike the house and the secondary circuit, and make an attempt to get on the line through the primary, again it is intercepted by the metallic strip and the integrity of the insulation between the primary and the secondary is maintained, no harm happening.

The precautions have been dictated by experience in the induction apparatus, and I may be forgiven when I say that any other difficulty which may present itself as time rolls on and the alternating systems develop in magnitude will be equally carefully and successfully met.

As an instance of the unmeaning glibness of the speech of some of those who desire to constitute themselves authority on the subject, but who have never qualified in any practical form, speaking of the dangers attending the use of the alternating current, in the New York *Evening Post* of June 5, a gentleman states that the danger attending the use of alternating currents will not be decreased, but contrarily, will be greatly increased by placing the conductors underground. It is evident that the gentleman has concluded that because with the underground low tension continuous system great difficulty has been experienced in properly insulating to prevent troublesome grounds and disastrous leakages, that all other systems, as a matter of course, suffer similarly. In point of fact the low tension current at 220 volts in underground conductors offers a far greater strain upon insulation than an alternating current at 1,100 volts. It will be known that one of the functions of a current flowing through a conductor is a heating one: that the greater the current transmitted through a given conductor the greater the heat; or, in other words, the heat developed is as the current squared into the resistance, $C^2 \times R$. It will further be known that with slow radiation, as must necessarily be the case with the conductors underground, the heating effect with a given current and cross section of wire must be enormously increased. With low tension continuous current systems it frequently happens during the hours of heaviest lighting that a loss of some 20 to 25 per cent. is incurred in the conductors, and any person familiar with the temperature that a conductor attains at such a loss as this will not wonder at the trouble of the low tension system and the consequent strain on the insulation. On the other hand, with the alternating current no such loss in the conductors need ever be permitted; throughout the hours of use they may, therefore, be comparatively cool, certainly never warm enough to prejudicially affect the insulation. The reason of being able to work at a low temperature in the latter case of course is that working with a current alternating in polarity, small in quantity and high in tension, we can afford to work at a much less waste of energy and corresponding reduction of temperature in the conductors; therefore, the insulation of the wires in the latter case need never be strained; the strain on the insulation by the use of the higher E. M. F. being more apparent than real. These conclusions have been arrived at by careful practical experiments that no amount of sophistical theorizing can refute and are equally within the scope of all who wish to familiarize themselves with a few elementary facts.

By the use of the alternating current as now employed by companies long in the field, who have a reputation at stake, the electrical engineer has placed in his hands an electrical lever, so to speak, with which he may move the world, practically the greatest of all electrical developments of the age, of incalculable value and far-reaching possibilities; and any objections to its use (and their name will be legion) by interested persons, should be regarded and dealt with carefully and impartially as affecting something of immense public value as well as something of future public value that at present it is impossible to overestimate, and should not be too hastily condemned in consequence of the utterances of the inexperienced.

Yours very truly, MARMADUKE M. M. SLATTERY.

OFFICE OF RALPH W. POPE,
Consulting Electrical Engineer,
No. 30 Temple Court,
NEW YORK, July 9, 1888.

Hon. Theodore Moss, Secretary Board of Electrical Control, New York City:

DEAR SIR: I have the honor to acknowledge the receipt of a copy of the minutes of the proceedings of the Board, dated June 8, containing a resolution in which my opinion is requested, regarding certain suggestions as to the amendment of the rules of the Board, proposed through the public press by Mr. Harold P. Brown, which are as follows:

RULES FOR STATION LIGHTING.

1. Not more than fifty arc lights shall be operated upon any one circuit, unless said circuit is used exclusively for street lamps mounted upon wooden poles; in this case the number must not exceed sixty.

2. All out-door arc-light circuits must be provided with waterproof covering having an insulation resistance of not less than one-half a megohm. Any circuit falling below this must not be used until restored.

3. No arc-light dynamo shall be operated unless provided with a voltameter across its terminals, or other device, to provide a path for the extra current, caused by the opening of the external circuit.

4. No arc-light dynamo shall be operated unless provided with means for automatically stopping the production of current the instant a ground connection is made upon its circuit.

5. No arc-light dynamo shall be operated unless provided with means for automatically breaking or short circuiting the field circuit the instant the external circuit is broken, in order to prevent a current from being built up by the broken circuit ends falling upon some conductor.

6. No alternating current with a higher electromotive force than three hundred volts shall be used.

I have also read the communication of Mr. Brown accompanying the proposed amendments. It has been my privilege to attend a large proportion of the meetings of the Board, and I believe I thoroughly understand its desires in the premises, which are in the main, to bring about a reform in the existing condition of electrical conductors in this city, without interfering with the business interests of their owners or depriving our citizens of the many benefits accruing from the various systems which depend upon electricity for their successful operation.

One of the greatest difficulties encountered in the proper regulation of electrical service prevails in other branches of modern industry, where the danger to life is outweighed by the desire to increase financial gain. These facts are so generally recognized that I refer to them merely as a reason why it is proper that every precaution which science can devise should be utilized for the protection of human life. The rules in question appear to have been framed with this object in view, and so far as they are confined to this praiseworthy object they meet with my unqualified approval.

It is now the generally accepted opinion among scientific investigators, many of whom have had ample experience upon which to base their reasoning, that there is a wide range of difference between various persons as to their power of enduring the effect of an electric shock. The same person may also be much more susceptible to its influence under certain conditions of the body, as for instance when the skin is moist from any cause. A person unaccustomed to the peculiar sensations caused by the passage through his system of an electric current, if of a sensitive nature, may suffer from fright. Indeed the mere spectacle of a thunderstorm, where the chances of personal injury from lightning are infinitesimal, may produce serious results. It will therefore be understood that it is extremely difficult, if not impossible, to fix upon an arbitrary standard which an electric current must not be permitted to exceed; for the reason that many useful classes of service may thus be entirely prohibited without any substantial reason. All forms of electricity as used in the various systems with which we are familiar, are entirely controllable, with the exercise of such skill and experience as now exist. No form of current is used which, with the exercise of proper precautions, cannot be confined to its legitimate path, and it is in this direction that it appears to me our efforts should be directed. When with the introduction of every known precaution it is found impossible to so confine an electric current to its proper channel it will be time enough to prohibit it by statute. The very fact that many of the companies now doing business have not exercised that precaution which the interests of the public demand is the reason for the existence of the Board of Electrical Control. In view of the prevailing opinion upon the importance of so constructing and operating an electrical plant of any description, it appears to me that any company or individual proposing to establish an industry of this character, at this date, must be well aware of the importance of complying with such rules as are established by the proper authorities acting in the interest of the public.

The pith of the line of policy to be pursued, in my opinion, therefore, would be not to fix upon any particular number of lamps to be operated on one circuit, or any standard of voltage which must not be exceeded, but rather to insist upon such methods of construction and the use of such material that the current will be confined to its designated conductor. This implies the use of a conductor of ample size for the current to be used and properly insulated at all points, the insulation resistance increasing in a proper ratio to the increase of voltage.

If we aim constantly in this direction, I believe we shall eventually attain the end we all have in view, which is the greatest possible extension of the benefits to be derived from the more general use of electrical devices, without danger either to life or property, even where the various fixtures and appurtenances are necessarily within the reach of persons not familiar by training with the mysterious dangers which are supposed to lurk in every electric wire.

I would, therefore, respectfully suggest that the first and the last of the proposed rules be stricken out, and that the second rule be more fully elaborated.

In view of the fact that with the best possible methods of construction accidents are liable to happen, rendering an otherwise perfect system defective, I should recommend the adoption of the precautionary rules Nos. 3, 4 and 5, provided there be no existing practical reasons why they should not be enforced, as I am not in favor of the adoption of any regulations of such a character that they must necessarily remain a dead letter. Yours very truly,

RALPH W. POPE.

STEVENS INSTITUTE OF TECHNOLOGY,
HOBOKEN, N. J., July 16, 1888.

To the Board of Electrical Control:

GENTLEMEN: In response to a letter from Mr. Theodore Moss, dated June 20, inviting me to express my views on the subject discussed by Mr. H. P. Brown in a letter to the *Evening Post*, bearing date June 5, 1888, I would say that I quite agree with Mr. Brown in his opinion that in all cases mentioned by him in which death has been caused by coming in contact with electric wires, the accidents would have occurred, just the same, if the wires had been buried underground, or to use his own words, "I know that burying the wires would not remedy the trouble." I would, however, go further than this and say that in the instances he cites, and in all others known to me, the accident which occurred would have been more likely to occur or more certainly fatal if the wires had been buried underground in any arrangement which has as yet been provided for that purpose, and this chiefly for the following reasons:

The buried wires, as experience has abundantly shown, are in constant danger of making earth connections which render a contact with only one point fatal where it would be otherwise harmless. Even the Edison wires in New York are frequently being torn up to repair injuries due to loss of insulation, notwithstanding their very low electromotive force of but 110 volts, as any one can see who has occasion to go about the streets traversed by the Edison conductors down town.

When currents of twenty times this "electric pressure," as it has been aptly called, are used, this tendency to rupture the insulation is proportionately increased and has proved practically fatal to any commercial success in using such currents through underground conductors.

Those persons who have been killed by touching lamps or single wires have been killed only because there was some earth connection already established elsewhere on the circuit. Again, in the instances where employés of the electric companies have been killed while employed in connecting or otherwise working with wires carrying currents, it is manifest to any one that the danger would be greatly enhanced if their work was to be done in dark and narrow "man-holes" instead of in broad daylight and

in free space. The cry of the public, as represented by the daily press, to put the wires underground as a remedy to all dangers and difficulties, is not an intelligent cry, but, on the contrary, is the result of ignorance and misdirected prejudice.

In the next place Mr. Brown points out at some length the difference between a continuous, uniform, and a pulsating or alternating current, but in this connection I think that he has rather mixed up and confused several different things.

The intense effects produced by an induction coil such as is used for giving shocks and in medical treatment is not the result of its interrupted character, but of the peculiar arrangement of magnetic core and coils of wire by which the electromotive force of the interrupted secondary current produced is raised to a point fully equal to that of the longest circuit ever employed in an arc light system.

In other words, the *electric pressure* obtained in a medical coil is fully equal to that in an arc light circuit carrying 50 lights. It is also alternating and, therefore, as far as these conditions are concerned, should be certainly fatal. Such, however, as every one knows, is not the case. I myself once received the discharge of such a coil capable of giving sparks 21 *inches long* and, therefore, in electric pressure to hundreds of arc-light dynamos united for that purpose, and the sensation was no worse than the shock from a Leyden jar of moderate size. It is manifest, therefore, that the interrupted or alternating character of the current, even when combined with the highest electric pressure, is not its essentially fatal condition.

The actual facts seem to be these, as far as we can gather from the fortunately very limited number of accidents, fatal or otherwise, which have occurred.

There are two ways in which the electric current can derange the living structure. First, by mechanical and chemical injury to the organic structure. Second, by nervous exhaustion or nervous shock.

The first of these requires the passage of a considerable volume of current with enough electromotive force to carry it through the resistance of the body. These conditions are fulfilled by a continuous or uniform current of high electromotive force, and are not found in the same degree in an alternating or interrupted current.

The second method of injury, or that by nervous shock, requires chiefly the interruption or reversal of the current, but this nervous influence only becomes dangerous when long continued or combined with the other influence of large current volume.

Experience, however, shows that the interrupted current loses as much in the direction of fatal effect from organic destruction as it gains from its superior nerve exhausting power, so that quite as many have escaped without fatal consequences from an alternating current as from a continuous one. Either may be fatal, but neither has any known superiority over the other in this respect, and there is certainly nothing in the results of experience or observation so far which would warrant us in requiring less precaution in the use of one sort of current as compared with the other, or in excluding one where the other was admitted.

Mr. Brown states, as of his own knowledge, "scores killed and maimed by the pulsating currents." In regard to this I can only say that I have no such information, either direct or derived, and would be very much interested in investigating these scores of cases, if Mr. Brown would give some specific reference to them.

I quite agree with Mr. Brown as to the imperfections of the underwriter's wire. This wire was passed or allowed by the underwriters many years since when it was the best and only wire available for the purpose, but they have since "approved" many other wires with superior insulation which have just as much claim to be called "underwriter's wires" as the first and inferior kind.

What Mr. Brown says about the universal condemnation of the alternating system by electricians of high standing and disinterested must be founded upon a very limited knowledge of the subject. The only authority he cites is that of Siemens & Halske, who are known to everybody as manufacturers of, and dealers in, dynamos, electric lamps, etc., patented by themselves, and authors of a pamphlet or trade circular attacking the rival system of electric lighting by secondary currents with so manifest a bias as to deprive what they say of any weight whatever. I can hardly believe that Mr. Brown can have seen this publication, but must speak from some incorrect report of its contents.

Without taking up more of your time, however, with a discussion of Mr. Brown's preamble, I will at once pass to his proposed rules.

Rule 1 proposes limiting arc circuits to 50 or 60 lamps each. This would be a very unscientific and unfair method, as it would allow some companies to run circuits of twice the electromotive force or pressure of others. Thus, 50 Brush lamps would require an electromotive force of 2,500 volts, while 50 U. S. Electric Lighting Company lamps would require but 1,500 volts. The rule should be founded on some accurate standard of measurement, and not be like the weight standards of the early Dutch settlers described in *Knickerbocker*.

Rule 2, providing for insulation of wires, as stated, is utterly indefinite and meaningless. Under it a naked copper wire might comply with the requirements and the Atlantic cable might fail to do both within reasonable constructions of the rule as stated.

Rule 3, providing for a cross circuit of high resistance near the dynamos, is also indefinite and unnecessary, but would do no harm.

Rules 4 and 5, providing automatic means of shutting off dynamos on the grounding or breaking of their circuits are good, but are already carried out in most electric lighting systems.

Rule 6, excluding the use of alternating currents of high electromotive force is unwarranted and absurd.

If more time were at my disposal I could enlighten your Commission on many other points connected with this subject, but believe that I have said enough already to discharge my duty as a good citizen in a matter in which I have no direct concern.

Very truly yours, HENRY MORTON.

PITTSBURGH, PA., July 7, 1888.

C. H. Jackson, Esq., President Safety Electric Light & Power Company, New York.

DEAR SIR: In reference to the questions which you have brought up for my consideration regarding the safety and reliability of the alternating current system of distribution I would say, first, in regard to the matter of personal safety that I regard the alternating current less dangerous to human life than the direct current for several reasons. In the first place I am well acquainted with a number of electricians and men connected with electric lighting work who have received through their bodies a current due to alternating difference of potential, varying between 1,000 and 2,000 volts. I have myself received 1,000 volts without even temporary inconvenience, and in the case of one of the electricians connected with our interests, a shock of something greater than 2,000 volts was received without fatal results. During my experience with direct current dynamos, I have frequently received a shock due to the extra current from the field of a machine suddenly opened, and I have no hesitation in saying that the shocks I have received in this way from machines designed to produce only 100 volts electromotive force, were much more severe than those I have received by direct contact with the primary circuit of a Westinghouse 1,000 volt dynamo, when its field was charged to the full normal amount.

It is simply out of the question to produce any practicable extra current in the armature circuit of an alternating current machine from the opening of the field particularly when the machines are separately excited; and this is for the reason that there is no connection between the armature and the field circuits, and the effect of suddenly interrupting the field current is only to interrupt the current in the armature without producing a sudden flash of high electromotive force which inevitably follows from the interruption of the field of a direct-current machine. The construction of the alternating current dynamo is such that, although the current changes its direction 200 or 300 times a second, yet it is prevented by the very nature of the machine from raising any potential beyond a certain limit determined by the design of the machine. In the direct current machine, on the contrary, there are no such restrictions, and I feel quite safe in saying that the discharge from the field of a direct current machine of 100 volts, normal potential, may be capable of rising to fully 1,000 volts when the field circuit is suddenly interrupted.

I do not give this as a matter of opinion solely, but as a matter of actual experience and conviction. This quality of the direct current machine has often rendered it necessary in my own experience to interpose a number of incandescent lamps, say five or six, across the breaking points of the field rheostat, so that on the interruption of the field circuit the arc formed across those contacts would be prevented to some extent. The result of this arrangement is that half a dozen or more lamps connected in series would be flashed up to their full brilliancy by the so-called 100 volt dynamo; whereas, under normal conditions, it would require as many 100 volts as there are lamps to produce a similar condition.

There is a very convincing reason for the small danger due to alternating current shocks to the human body as compared to those received from the direct current, namely, the fact that the conducting fluids are more or less decomposed or electrolyzed by the passage of the direct current, while it is well understood that such an effect is not produced by the alternating current. It is therefore evident that the passage of the direct current through the human body, for even a moderate length of time, may be sufficient to so decompose the fluids and tissues of the vital parts as to produce fatal results very quickly, whereas a current of the same quantity, of rapidly alternating potential, may produce only a shock to the nerves without any organic change, consequently without permanent or even serious danger.

This statement is well borne out by the fact that it is impossible to measure correctly the resistance of the human body by means of a direct current, as the resistance changes continually while the measurement is in progress, even where the contacts are preserved carefully and where the utmost care is exercised to produce accurate results. The decomposition of the fluids thoroughly explains this, since it is a well-known fact that in all cases of electrolytic action the resistance is never the same for any considerable period. With the alternating current system it is possible to obtain definitely the resistance of the human body with contacts of a given nature; consequently the effects of the alternating current can be determined and counted upon much more easily than the direct.

Laying aside the question of the relative danger of the alternating and direct current, it is a matter of every day experience that a 50 or 100 volt alterating current is perfectly safe and it is perfectly possible and easy to confine the difference of potential entering a house from the street circuit.

The insulation on the converters as now employed and as they have been in use since the commercial operation of the alternating current system is so perfect that among several thousand converters now in use, under the patents of the Westinghouse Company, I have yet to learn of a single instance in which any connection has been discovered between the primary and secondary wires. These converters have been in use under almost every conceivable condition of location, and surrounding conditions, and a large number of them are in use in the open air, and up to the present time no accident to life or property has been recorded. As a matter of fact the converter is a safeguard to the consumer, protecting him from all dangerous currents likely to traverse his wires, mainly that from lightning. Where the circuit is continuous from the pole line to the lamps an excellent conductor is provided for the discharge of the lightning flash wherever the ground insulation happens to be the weakest, and for this reason we hear of lightning entering buildings and destroying property to a greater or less extent, particularly at the central stations where the greatest number of conducting wires enter and where masses of metal more or less connected are apt to form the weakest points in the system of insulation.

Where the converter is interposed between the line wires, and the circuit is likely to be handled by the consumer, a safeguard is provided, the effect of which, on the passage of a lightning discharge, is simply to work an injury on the converter itself, separating it from the service wires and temporarily interrupting the supply of current. In the experience of our company a number of cases have occurred in which lightning has almost totally destroyed the converters and the result has been in every case to disable the primary coil, cutting it out of action and immediately freeing this circuit from the converter, owing to the increased current passing through the primary coil under these conditions. It will be impossible for the converter to remain in the circuit when sufficiently injured by lightning to render insulation between the primary and secondary circuits insecure. Under all other conditions than the burning out of the converter by lightning or destruction by fire, the nature of the insulation between the primary and secondary circuit is so perfect that it is almost impossible that any connection should occur between them, since the insulation is made up of several distinct and perfect envelopes for the wire. These insulations are as water-proof as it is possible to produce them, when uninjured by a mechanical abrasion, and from the latter the coils are thoroughly protected by an inclosure in the iron casing with which each converter is provided. The insulation is not only carefully carried out from the primary to the secondary coil, but between each coil and the iron plates which form the surrounding field, so that the insulation measured from one coil to the other through the iron is in reality double the insulation from coil to coil.

In regard to the question that has been raised as to the reliability of the safety fuses I would simply call attention to the well-known fact that the fuses of moderate size are much more quick and reliable in their action than the large fuses. The current in our system traverses four pairs of fuses between the dynamo and the lamp, all of which fuses are of moderate size, even where 2,000 or 3,000 lights are distributed over the same primary circuit. In case of accident by lightning, or otherwise, which would disable the converter, the usual effect is to immediately burn out the primary safety fuses of the converter: but, should this fail for any reason, the passage of any abnormal current through the secondary fuses would cut them out, and, failing in this, they would have still between the converters and the lamps the local fuses which are of still smaller capacity, and therefore readily discharged. I might amplify on these matters to a very considerable extent, but have confined myself to explaining the material matters in which our system has safeguards, which make it absolutely safe to life and property.

In conclusion, I might state emphatically that the converter, whether for underground or overhead use, and particularly in the latter event, is an element of safety of a very appreciable amount against danger from currents of higher tension than is used in the alternating system, which may, by any event, be brought into contact with the primary wires of this system.

Yours respectfully,

O. B. SHALLENBERGER.

PITTSBURGH, Pa., July 14, 1888.

Mr. C. H. Jackson, President Safety Light, Heat and Power Company, New York, N. Y.:

DEAR SIR: I am in receipt of your favor inclosing a clipping from the New York *Evening Post*, which clipping simply is an attack upon the alternating current system signed by Harold P. Brown.

I have carefully read this article and beg to call your attention to the following facts and observations in connection with the same:

About two years ago the Westinghouse Electric Company began the commercial introduction on a large scale of the alternating system of electric lighting. The advantages of this system immediately appealed to the wants and experience of parties already engaged in central station lighting, and of those who up to that time had been seriously considering to go into the business, but had not actually embarked in the enterprise in consequence of the absence of any system which would fill all the requirements in a commercially successful manner. The first plant introduced by this company on the alternating system in this country was started at Buffalo, N. Y., on Nov. 30, 1886. After that other plants were rapidly sold and put in operation until, at the date of this letter, the Westinghouse Electric Company and its licensee, the Thomson-Houston Electric Company, have sold in Canada and the United States a total of 127 stations using the alternating system, and of which 98 stations are in operation at the present time, the remainder being under construction. Among these 127 stations there are several which, to the best of my knowledge and belief, are the largest incandescent lighting stations in the world. Notably, the Virgin Alley station in Pittsburgh, which has a generating capacity of 15,500 16-c. p. lamps, and which, together with its substations, operated by the same company (The Allegheny County Light Company), in Allegheny City and East End Pittsburgh, make a total of 25,800 16-c. p. lamps on the alternating current system, in daily use in the city of Pittsburgh and Alleghany; being a larger number of incandescent lights served at the present time from central stations than in any other city in the United States. The plant of the Denver Light Heat and Power Company, Denver, Col., which was put in operation in December, 1887, is now supplying over eight thousand 16-c. p. lamps. The central station at Richmond, Va., which originally started with 650 c. p. lamps and subsequently increased to 2,600 16-c. p. lamps has now received another increase, giving it a total generating capacity of 7,600 16-c. p. lamps on the alternating system. The station at New Orleans originally operated by the Southwestern Brush Electric Light & Power Company, but now the property of the Consolidated Electric Light Company, has over 7,500 16-c. p. lamps in sucessful operation. At Baltimore, Md., the Brush Electric Light Company of Baltimore City has just started a station of 500 lights. The Richmond Light, Heat & Power Company, of Staten Island, N. Y., has a station which at present is operating over 4,000 16-c. p lamps.

Of the stations which are in operation at the present writing, and all of which have been sold and installed since Nov. 30, 1886, thirty-four have increased their plants since putting them in operation.

You will readily understand, upon a consideration of the foregoing, the enormous amount of work which has devolved upon the officials, electricians, and engineers of the Westinghouse Electric Company, in developing and introducing this enormous business within so short a time, and that it has been considered inexpedient, heretofore, to take any notice of, or make any reply to, the criticism and attacks of some of the opposition electric lighting companies, which have developed recently in a method of attack which has been more unmanly, discreditable and untruthful than any competition which has ever come to my knowledge. The article of Mr. Harold P. Brown, referred to, is a fair sample of this class of attack. I have neither the time, nor the inclination to answer in detail the charges brought forward by Mr. Brown, nor indeed do I consider it at all necessary, as in spite of this and similar attacks above mentioned, the business of the company is steadily increasing, and the only result produced by such articles is a certain amount of annoyance.

However, I would say briefly, and all of which we are prepared to have substantiated by an intelligent and thorough test and examination of our system by any competent engineer or engineers:

In the first place, an alternating current is far less dangerous as to fire or life risks than a current of what is known as the continuous or direct current type. This is a matter which can be readily proved by breaking two currents, one of the alternating, and the other the direct, by the same switch. In the case of the direct current, a long and vicious spark will occur, which, if the current is of sufficient volume, will probably melt the edges of the switch. With the alternating current a spark barely perceptible, and with none of the heating and melting effects, will be observed by the same operation.

As to life risks, it has been demonstrated to our entire satisfaction, and the entire satisfaction of people who have given the subject an intelligent investigation, that the effects of currents of the two systems, upon animal life, are very unequal, and the effect of the alternating current is immensely less, both as to burning and possible death, than the direct current of the same volume and pressure, as explained by Mr. Shallenberger.

Of the 98 central stations of the Westinghouse Electric Company, now in operation, and all using the alternating system, we have yet to receive knowledge of a single case of fire of any description, from the use of our system. Of the 125 central stations of the leading direct current company, there are numerous cases of fire, in three of which cases the central station building itself was entirely destroyed, the most recent being the destruction of the Boston station, while among the almost innumerable fires caused by this system, among the users, may be mentioned the total destruction of a large theatre at Philadelphia, which fire was directly caused by the direct current system of the leading direct current electric light company of the country.

Regarding the alleged life risks by the use of the alternating current system, I would say that the potential, or pressure, or electromotive force used on the primary lines with the system of this company is one thousand volts, as against a pressure on the three-wire, direct current system of two hundred volts. Greater care in running these primary wires, either overhead or underground, is required than would be the case if a lower pressure were used, and, it is possible, under certain contingencies, for a person through carelessness to become so connected with these primary wires as to receive a shock which may possibly prove fatal; but this risk is reduced to a minimum. It is a common matter for the 3-wire central station companies using the direct current system to run a special wire usually for street lighting purposes, carrying a potential on the direct current system of 1,000 volts, and which, as explained above, is certainly more dangerous in every way than 1,000 volts of the alternating system. It must be distinctly borne in mind, however, that the street wires carrying the primary current of the alternating system are never carried into the houses, and that the current which goes into the buildings and houses to feed the incandescent lamps has an E. M. F. of 50 or 100 volts, as against an E. M. F. of 200 on the 3-wire system. And I further state, beyond any possibility of contradiction, that it is utterly impossible, by the construction of our apparatus, for a high tension current used in the primary wires to pass the converters and enter the houses. An intelligent examination of the construction of our apparatus will prove this beyond any question of doubt.

As to the alleged impossibility of the operation of our system on an underground circuit, I have only to say that any statement of this nature is absolutely and entirely false. The company using our system in Denver, Col., and which has been referred to previously in this letter, has being employing our underground system very successfully with a distributing capacity of over 12,000 16-c. p. lamps. At Springfield, Mass., we have an underground system in successful operation with a distributing capacity of 2,100 16-c. p. lamps. At the Keystone Light & Power Co., in Philadelphia, they are distributing over 2,600 16 c. p. lights through an underground system.

We are prepared at any time to furnish plans or take contracts for the introduction of our system by underground wires and to guarantee its successful performance under all circumstances, so long as our plans and specifications are adhered to, and the very successful operation of the three underground stations mentioned, certainly is more assuring in this direction than the very unsatisfactory performance of the underground three-wire systems, which underground systems have been attended with continual trouble, and have required the most careful nursing from the time they were started up to the present moment. As, for instance, at Detroit, Mich., Columbus, O., Chicago, Ill., Philadelphia, Pa., not to mention others. Whenever local companies are willing to incur the extra investment required for putting the wires underground, we are also prepared to furnish them the system with sufficient guarantees for its successful performance.

The dismal commercial results so far achieved by the majority of central stations using the three-wire system, owing to the fact that the low tension which they are required to use with that system prevents the possibility of their covering a sufficient territory to insure a permanently successful business, certainly warrants the expenditure by local companies of a little more cost in installation and care in construction of their lines to enable them to use such a system as the Westinghouse Electric Company has so successfully introduced, and by the use of which system any local company can permanently occupy the field instead of being in a position where it is continually harassed, and having its business cut into by other companies coming into the same field, while it is itself unable to strike out and occupy new territory.

The idea of locating a central station in the heart of the most thickly populated section of a city or a town, as for instance, the three-wire system in Philadelphia, paying enormous sums for the haulage of coal and ashes, and even for the use of water for the boilers, when by the use of the alternating system of the Westinghouse Electric Company, the same stations could be located on some river bank, or contiguous to a railroad, thus avoiding all expense of haulage and for water, is surely one which does not appeal to the common sense and experience of the people who are acquainted with engineering enterprises.

In closing, I would call your attention particularly to what is probably the most recent attack against this company, and a consideration of which, together with the accompanying facts as put forth in printed circular enclosed, will, I think, make clear to you the utterly irresponsible nature of the parties carrying on such a campaign against us. I refer to the enclosed circular which has come into our hands marked "Confidential to Agents," and printed over the signature of Ed. H. Johnson, President of the Edison Electric Light Company. This company, as you are aware, is using what is known as a three-wire low tension system. It is certainly manifest from this that the desperation of the opposition companies has reached a point where even a regard to their own interests is thrown aside, and the only explanation which I can apply to the issuance of the confidential circular in question is, to consider it as a last effort on their part.

The previous circulars and pamphlets which have been issued have been all of the same nature and are all susceptible of exactly as sweeping a reply as this, but, as explained previously, we have felt no injury resulting from the circulation of such literature and have neither the time nor inclination to reply to it.

Trusting that this rather lengthy letter has at least in a measure replied to your inquiries, and again stating that we are ready at all times to invite the intelligent examination of our system by parties who will do so in a fair-minded and straight-forward way, and in such manner as was done by the Society of Gaslighting of which Mr. Eugene Vanderpoel, president of the Newark Gas Light Company, Newark, N. J., is chairman. I remain,

Yours very truly, H. M. BYLLESBY,
Vice-President and General Manager.

OFFICE OF THE
SAFETY ELECTRIC LIGHT AND POWER COMPANY,
NEW YORK, July 7, 1888.

Messrs. Commissioners of the Board of Electrical Control of New York City:

DEAR SIRS: We tender our cordial thanks for the invitation extended us under the resolutions adopted at our meeting on June 8, 1888, concerning rules suggested in a communication published in the *Evening Post*, June 5th, 1888.

As we will use the Westinghouse alternating current system, our reply to your invitation will be confined to the proposed rule, reading: "No alternating current with a higher electromotive force than three hundred volts shall be used," and to the preceding paragraphs which animadvert on the alternating current.

The Westinghouse alternating current system for incandescent lighting is in successful daily use in some 82 central stations located in many states.

Some 45 additional central stations are being built to use the system, and this number is being increased at the rate of about two per week.

Those in use have lighting capacities varying from 2,000 lights to more than 18,000 lights each, and all are being constantly enlarged to provide for the continued increased demands.

For the distribution of the alternating current generated in these central stations, thousands of miles both of overhead and underground conductors are used.

Those numerous stations have been installed under the supervision of and managed by as many local superintendents, most of whom had been previously entirely unacquainted with the Westinghouse alternating current system.

In the construction of these many stations, with their numerous lights and miles of wire and cables, and in their daily operations in such extensive proportions, a very large number of employés have been and are now engaged who necessarily had no previous experience with the Westinghouse alternating current system.

Daily and hourly from these many stations the alternating current has been and is transmitted through miles upon miles of wires and cables to hundreds of thousands of lamps, providing light to millions of people, and, yet, up to this moment, the first death, due to this, as the publication in the *Evening Post* designates it, "damnable and fatal" current, has to be recorded.

Nor has there occurred a single instance of fire having been caused by the current from any of these stations. And the electromotive force in all the main or feeding conductors, from all these stations to the converters, in every instance, is at least 1,000 volts.

Among the numerous employés of these stations, are living very many who have received direct from the generating machines, at the bare wires of the switch boards, the full intensity of this current.

They received severe shocks, it is true, and the experience was not pleasant, but they were not killed. In most cases they continued at their work without interruption of more than an hour; they were not even made sick or nauseated. Facts like these show as much as anything can possibly demonstrate that there is not "constant danger of sudden death" in the use of this current, to which it is stated in the communication in the *Evening Post* "that the public must submit in order that corporations may pay a little larger dividends." The utterer of such wanton statements, if not employed by some company to issue such a villainous budget of perversions of fact, must be desirous of achieving a cheap reputation, with the general public, who imbibe the notion from the numerous misstatements of ignorant or dishonest persons that there is inherent danger in any use of electricity.

We submit herewith a letter from Mr. T. Carpenter Smith, who has been the superintendent of a station with 15 000 lights operated upon this system. He has had many years experience with electricity in all its forms, and knows the Westinghouse alternating current system by constant practice of several years. He has embraced in his own person this "damnable and fatal" current of 1,000 volts, and that more than once. He has seen, as he narrates, several men receiving this current without any more inconvenience than burning of the hands and perhaps the absence of a half hour from their work.

We also submit a copy of a letter from Mr. W. H. Cole, superintendent of an electric light company at Richmond, Va., using this same alternating current. His experience has likewise been with many and various kinds of electricity for a number of years past. He, like Mr. Smith, has received in his own person this "damnable and fatal" current several times, and he has several men in his employ who have received it also. We also submit copies of letters from the general manager and electrician of the Westinghouse Electric Company, which make valuable contributions to the subject and merit the utmost consideration.

Our station at Twenty-fourth street and Thirteenth avenue will be erected in the best possible manner known to modern science; provided with all the appliances of the best steam and electrical skill. From that station the current will be conducted by lead covered insulated copper cables laid in conduits, constructed under your supervision and direction. From these feed mains will be conveyed similar cables through subsidiary or distributing ducts, provided with handhole openings below the pavement at every house line. From these handhole openings will be similar cables laid in ducts beneath the ground to the house or vaults, if there be any, under the sidewalks. Against the cellar wall or in the coal vault under the sidewalk, as the case may be, will be placed our converters. This converter, by its construction, converts or reduces the electromotive force which it receives to any given pressure that we may desire, never exceeding one hundred volts and being ordinarily but fifty volts. This converter may be likened to a reducing valve upon a steam conveying line, such as is frequently used in many buildings in this city and elsewhere, where this boiler plant is required to be at a high pressure for the purpose of running engines and other machinery, which requires high pressure; and at the same time to provide steam at a low pressure for heating rooms. We suggest this comparison in order that persons unfamiliar with electricity may be able to comprehend what is meant by conversion or reduction of electricity. We present herewith for your inspection and examination one of the converters such as we intend to use. An examination of it will show that the assertion that, "between these two circuits is interposed nothing more than a thin layer of cotton and silk insulation," is very wide of the fact. This assertion is followed by another that, "as has happened again and again, it requires but a flash of lightning or a little moisture in the converter to bring the death current to each lamp." Both assertions seem to have been made in ignorance of the fact that this very converter which we show here, and whose construction you can so readily understand, is full of the strongest elements of safety against the danger which he suggests as liable to occur from a flash of lightning, and is a source of safety in this alternating current, which is entirely absent from the system lauded and approved of so highly by the author of the assertions. This converter has been by an advocate of the continuous current called a lightning arrester. Those who are informed, know that before it would be possible to bring the death current of a flash of lightning to each lamp, the converter must be entirely destroyed and there must be a termination of the death current, as it could not pass through the destroyed converter, for there would be nothing by which it could pass; whereas, in the direct current system nothing interposes to prevent the continuous passage of a lightning flash to each lamp; but the suggestion as to a flash of lightning, if it be entitled to consideration in any way, has no bearing manifestly on underground wires, and we wish to use nothing else.

In addition to the converter for reducing the voltage which we carry in our mains are safety fuses, which, should a current possibly pass beyond the converter, exceeding the voltage we desire to have in the house, would instantly fuse and break the circuit, beyond which current could not pass; but, assuming that the current, in all its intensity of the mains, should pass this converting apparatus in its full pressure, and should fail to melt the safety fuses, and should pass along the conductors to the lamps, then again would the circuit be broken at each and every lamp. Then, in order that any danger not of death, but of shock, could occur to any one, it would be necessary to take hold of both wires (and they should be bare at that, while those we use are thoroughly insulated) in order to obtain a current through him and to the ground.

In all of our wiring we use as a matter of business economy the highest class of insulated wire, carefully made to undergo any test that can be reasonably asked for by any expert. This insulation thoroughly protects every particle of wire from our station to each and every lamp and renders it absolutely impossible for any one to come directly in contact with the bare wire, except in possible cases of accident, such as fire in the building or similar circumstances, which would disrupt every connection made by us. In such cases, in order that any danger of any kind should occur to persons within the building, it will be necessary, as heretofore stated, that the current pass in its full intensity through the converter, unreduced and untransformed, and that the safety fuses fail to melt and that the person take hold of both wires in order to complete a circuit. The probabilities of this series of concurrent circumstances occurring are, as is evident from the facts of the case, almost unlikely. All persons who have received shocks from the alternating current have been those employed in or about the stations, whose duties took them to the switch-boards or to the wires connected with them directly from the machine, and even these have not suffered more than a temporary inconvenience.

We use an electromotive force of 1,000 volts in our mains for the purpose of conveying current long distances, avoiding thereby the placing of generating stations in many parts of the city. Generating stations, as well as any similar establishment, are not desirable to the residents of largely inhabited neighborhoods. With our lead covered insulated copper cables, which can be laid in the earth or in specially constructed conduits with equally good results, and with an electromotive force of 1,000 volts, electricity by our system can be served underground as readily as gas or water.

With generating stations situated on the river front, such as the one we are constructing, and the conveyance of the current underground, as we desire to have customers in the thickly populated districts of the city, very large benefits to the city in many directions are accomplished, and no detriment in any respect can be shown.

The application of the rule proposed is therefore manifestly as unwise as uncalled for. In proposing this rule, accompanied by such violent arraignment of the alternating current and reckless disregard of the history of the system we will use, the proposer, if he sought to benefit rather than to wrongfully alarm the public, should have given facts, if he had any, derived from individuals capable of honestly deducing and stating facts from their experience, which would justify the adoption of any such rule.

We have not wished to promote any discussion between the respective merits of different systems of electric lighting; neither have we undertaken to illuminate the electrical record of the party whose name is suspended to the publication in question, nor to indicate the reasons for the prejudice thereby displayed against every system except the one in whose behalf the diatribe seems to have been prepared. But we deem it proper to say in view of the facts we have given concerning the Westinghouse alternating current system, which prove that the alternating current is not a "damnable and fatal" current, that the paragraphs preceding the proposed rules were uttered by one who was doubtless entirely ignorant of the system we will use, and who, consequently, if of honest purpose, should have refrained from such in-

discriminate epithetic denunciation of the alternating current. Or if he were fully informed, as assuredly he should be in assuming to give promiscuous electrical instruction, unless he is one of that innumerable caravan who boldly "rush in where angels fear to tread," then he sought for some certainly not honest purpose to mislead and disturb the public mind by the use of alarming adjectives and misstatements, which, instead of facts, comprise all that we can find in his document concerning the alternating current.

We are well pleased, however, that your Honorable Board has made use of this publication as a vehicle for obtaining an intelligent discussion of this subject, for we know that the result must be that you will with pleasure approve the Westinghouse alternating current system, such as we propose to use, as being excellently adapted to meet the growing necessities of our city for electric lighting; and that you will, in the interests of the public, set aside suggestions emanating from ignorance or malevolence, and discountenance assertions which vary so widely from the experience of so many.

Very respectfully,
THE SAFETY ELECTRIC LIGHT & POWER CO.
WM. H. BROWNE, Treasurer and Manager.

To the Board of Electric Control, New York City:

GENTLEMEN—We are in receipt of a marked copy of the minutes of your Board containing rules for station lighting proposed by one Harold P. Brown, electrical engineer, and, at your invitation, we would submit the following considerations upon the subject:

The author of the article printed in the *Post* and of the proposed rules and regulations is a professional electrician and inventor, and, as we are credibly informed, is now in the employ of the company which uses what Mr. Brown terms a "closed circuit armature" for its generators. If we are right in this supposition, the constructor of the rules and the author of the arguments advanced in the article cannot be supposed to be free of bias. We think it proper to call the attention of your honorable Board to these matters because it seems evident to us from the whole tenor of the printed article that it is an attack upon all other systems of electric lighting and distribution which could by any possibility be rivals of the system with which Mr. Brown is identified, and that some of the rules suggested are made rather with a view to injuring rivals than with a purpose of protecting the "dear public."

As Mr. Brown subscribes himself an electrical engineer, and as your Board has seen fit to take notice of the article, it is fair to presume that the profession of the author has carried some weight with your Board in inducing it to submit the rules for the consideration of other companies with a view of possibly adopting them. In that view of the case it would seem not improper to inquire whether the knowledge of Mr. Brown, as displayed in the article, is such as would entitle him to credit as an electrical engineer.

In historical matters alone an inaccuracy is displayed with regard to the art which at this day is hardly to be expected of any one of Mr. Brown's profession. For instance, it is stated that "open circuit armatures" were pioneers in electric lighting and that at the time they were invented it was supposed that the "closed circuit armatures which produce the steadier and safer current could not be made to develop sufficient electromotive force to operate a number of electric arc lamps upon one circuit." The fact of the matter is that the machine with the closed circuit armature, which is known as the invention of Gramme, was one of the first types of machines to be employed in arc lighting. The Siemens machine as used for arc lighting is another case in point, as also the system exploited by William Hochhausen in this section in 1878 and 1879. The fact is so well known to electricians that further statement on the matter is not necessary.

Mr. Brown has further attempted in his article to draw a distinction between what he terms the "open circuit armature" and the "closed circuit armature," in regard to the nature of the current, the closed circuit armature being commended because it is supposed to produce a perfectly smooth current, while the open circuit armature is condemned on the ground that it produces a "pulsating" current, and that the current produced by it is the same as that of a medical battery having an induction coil and a circuit breaker in the primary. There is no similarity in fact whatever between the currents produced by these two devices. Your Board's expert will tell you that an "open circuit" armature never breaks the circuit for the lamps or other devices, and that there cannot therefore be a current of the same nature as that produced in an induction coil where the primary circuit is absolutely broken. The current of the "open circuit" armature, it is true, pulsates slightly, as does also that of the "closed circuit" armature, but the extent of each pulsation is not in either case the whole pulsation of any one part of the armature, but a tendency to pulsation is counteracted by the fact that while the current in one coil is rising or falling, as the case may be, the current in other coils, connected at the some time to the circuit, is rising or falling, and the resultant effect is a current very nearly uniform. In some machines, the tendency to pulsation is further counteracted by what is known as electrical or magnetic inertia of the armature, which causes a prolongation of the currents, so that the lapping of the currents upon one another is extended, and the sharpness of pulsation reduced.

There is not, as Mr. Brown would have the public understand, the difference in danger which he assumes between the use of a "closed circuit armature" and an "open circuit armature." The records of deaths do not support his views, and if there be any difference in the number of casualties we believe that it will be found to be due to the difference in the electromotive force of the machine employed, or to the predominance of the systems using the "open circuit armature." The closed circuit armature, as at present constructed, does not lend itself so readily to the production of high electromotive force, and the running of a large number of lamps in series; at any rate such has been the history of the development of the art. The open circuit machines have been practically constructed so as to run more lamps in series, while the companies using the closed circuit armatures have found difficulty in making successful and reliable machines which would run arc lights in series up to the number which it is possible to employ with the machines of their rivals. There seems to be no doubt that there is a limit of electromotive force and quantity of electric current which can be passed through the human system without producing fatal effects. Just what that limit is with any particular kind of current is not established, and it certainly is not established that any particular kind of current is necessarily more fatal than another. No conclusion on this subject can be drawn from the effects produced by an ordinary induction coil, the nature of whose secondary current differs so greatly from that of arc lighting circuits. If electromotive force or tension were the quality alone which determined the injurious effects of an electric shock the ordinary induction coil should be far more fatal in its effects than the ordinary electric light current of even (3,000) volts, inasmuch as the electromotive force of the current from the secondary is, as is well known to electricians, enormously greater. The voltage of the alternating current which would be used in practice is like that of the present arc light currents, far below that of a medical induction coil, and there is even reason for supposing that the alternation of current would tend to prevent destructive effects, each current tending to undo the work of its predecessor.

The rule as to the quality of insulation to be used for out-door arc circuits we see no objection to, and this company in fact takes particular care to run circuits of the quality demanded by the rule.

The third article provides that no arc dynamo shall be operated unless provided with a voltameter to provide a path for the extra current of the field magnets on the opening of the external circuit. We see no reason for the adoption of this rule. In the first place the condition which this rule is intended to provide for can only come about by the exercise of the most culpable carelessness on the part of the linemen in introducing their bodies into the circuit of the machine. The same order of intelligence which in a lineman would lead him to take hold of an electric current and then break the circuit between his hands, allowing his body to be inserted, would lead him, like the proverbial Irishman, to cut the limb on which he is standing, between himself and the tree. Again, it is not practicable to employ a voltameter or resistance which would be reliable in operation in the manner proposed without destroying the efficiency of the system.

Thirdly, it is not conceivable that any appliance, such as proposed, could be used which would operate before the effects of the extra current would be felt and would do their work upon the victim.

The fourth rule, if it can be satisfied by practical means, is to be commended.

The expedient proposed by Mr. Brown of a constant earth connection at the station, is not practicable, and we do not know how such a requirement of the rule could be satisfied. There can be no question but that the introduction of the ground connection would introduce an element of weakness into the system and would simply invite the production of the dangerous conditions which it is the object of the rule to eliminate. We would state here that it is the practice of this company to employ frequent and careful tests of its line for determining whether there is a ground connection of the circuit.

The application of this test at frequent intervals is sufficient for all practical purposes, but the establishment of the permanent ground connection would not be permissible, inasmuch as it would simply invite the production of dangerous and objectionable ground connections at other points of the circuit.

The condition provided for by the fifth rule is so remote that we do not believe there is any occasion for enforcing the use of apparatus such as proposed, and we would at this point suggest to your Board the advisability of inquiring whether the special devices suggested by the third and fifth rules are not covered by patents or applications for patents, so that the enforcement of the rule in the manner proposed would put it in the power of the company owning such inventions to make all its rivals pay heavy tribute.

As to the fifth rule, we would say further that the ordinary indicating appliances in use at present on arc light circuits are sufficient to indicate immediately the rupture of an external circuit, and that under such conditions the machinery should be stopped. If despite the indications which are present at the station the person in charge would continue to run the apparatus he would do so despite the provision of a device such as suggested by the rule. We would say further that in the behavior of the machinery at the station an indication to the skilled attendant is given of the condition which the rule is intended to provide for. It is not conceivable that the wires at present in use should break and that both broken ends should fall into connection accidentally with a conductor with which they would make sufficiently good contact to permit the apparatus at the station to operate normally. The breaking of an ordinary circuit wire, such as at present in use, is in itself a contingency so excessively remote as to hardly warrant consideration. It is a contingency at any rate that is sufficiently provided for by a provision as to the tensile strength of wire which a company should be permitted to use. This company operates its lines with a No. 4 wire, the strength of which is amply sufficient to prevent breakages under the most adverse conditions.

The sixth rule with regard to the electromotive force permissible in systems employing alternating currents is simply prohibitory upon the use of such systems. There is not even under the most unfavorable view which can be legitimately taken, such a difference in the danger from the use of alternating currents and continuous or ordinary arc light currents as to warrant the requirement proposed under these rules. The first of the suggested rules allows an electromotive force of from two thousand five hundred (2,500) to three thousand (3,000) volts in the case of ordinary arc light currents. The last rule practically allows but a tenth of that voltage in the case of alternating currents. It is no more than right that your Board should take notice of the fact that there has been a systematized attack made upon the alternating system by its business rivals, and for that reason alone any objections to the systems should be received with hesitation. The practical commercial advantages of the alternating system are such that it cannot be suppressed. The progress of development of the art of electricity is unquestionably in the line of alternating currents, and for reasons which all electricians will recognize.

Recent inventions have made it practicable to operate electric motors from alternating currents without the use of commutating or circuit changing devices of any nature whatever in the motors. The importance of this attainment can hardly be over estimated. It enlarges at once the field of electricity as a distributor of motive power, a fact which certainly should not be overlooked in a city like New York, where so many and large manufacturing interests are located. This company believes that alternating current electric motors without commutators or circuit changers of any description are a practical thing, and the use of such motors on an alternating current system forms a part of the contemplated business of this company with reference to which it was organized and obtained its charter. Such business must form a large and profitable source of income to every company which shall either purchase or acquire the right to use motors of this description. The field for the industrial applications of electricity has within the last two years broadened in other directions beside in the matter of motive power. There can be no doubt but that electricity as a heating agent in welding, forging, shaping, and in almost every variety of metal working operations will be largely employed in the near future. This application of electricity has recently been developed in such manner that this company will undoubtedly make a rental of machines for welding, shaping, brazing, soldering, etc., by electricity a part of its business. In the practical distribution of electricity for this purpose, the alternating current is the sole and effective one, because it allows of the location of converters at any place and of a character requisite for producing the large volume of current required in welding operations. It is not possible to supply currents of a volume required for metal working operations by the direct system of distribution, owing to the enormous cost of the supply conductors.

There is no reason to doubt but that electricity will be used on a large and extensive scale within a short period for almost every business where a working or joining of metals in any way by heat is performed as a part of a manufacturing operation. It is a part of the business of this company to supply electricity for this as well as other purposes, and it cannot practically do so if the restriction proposed by the rules is placed upon the use of alternating currents.

The domain of electricity enlarges from year to year, and all indications point to the increased use of alternating currents because of the fact that the generators are simpler; that the electrical energy can be readily localized when it comes to the question of distribution: and that the system possesses undoubted advantages in the flexibility and ease of installation which cannot be gainsaid. We do not think that it is an advisable thing in a city like New York, where the business and manufacturing interests are so large, to impose restrictions such as proposed by Mr. Brown.

The objection made in the article of Mr. Brown, that the alternating current cannot be introduced into houses because of the fact that there is only a thin layer of cotton or silk insulation between the secondary and primary, is effectually disposed of by the application of a permanent low resistance ground to the secondary circuit, which would effectually dispose of the objection that a flash of lightning will bring the "death current" to each lamp. This is an expedient which this company proposes to introduce into all of its alternating current apparatus, and with the provision of proper insulation of the main conductors both in the converter and in the connections throughout, there is no reason whatever why the system may not be used with as great security as any of the ordinary electric arc systems.

Respectfully submitted,
THE EAST RIVER ELECTRIC LIGHT CO.,
By Seymour G. Smith, Pres't.

The following affidavit made by W. L. Wright was presented:

PHILADELPHIA, }
CITY AND COUNTY. }

Wm. L. Wright, being duly sworn according to law, deposes and says, on the fifth of August, 1887, I was in the employ of the Keystone Light and Power Company, in Philadelphia, Pa., and had occasion to do work in the cellar of the building at Eighth and Chestnut streets, Philadelphia, occupied by the firm of Castor & Co. The electric wires in the cellar upon which I went to work had been, until a few days before, used for a 200-volt three-wire direct current system, and a socket had been attached to them by means of a long flexible cord to give temporary light in the cellar.

The wiring had then been changed and connected to the 1,000 volt alternating current, and forgetting that this current would be on the socket, I took hold of the socket while standing on the wet ground, when I received a shock which threw me on my face with my hand underneath me and still grasping the socket.

I have been accustomed to handling high tension currents and knew that I was in danger but was not able to call out to the man who was with me. I retained consciousness for some time but was gradually rendered insensible. When I came to my senses I was sitting in the cellar held up by two of the men. In the mean time an ambulance had been called but I refused to go in it, as I did not feel in any way injured except that my hand had been badly burned. I went down to the electric light station and waited there for fifteen or twenty minutes to receive my money, it being pay-day, and then went home. At the urgent request of the officers of the company I went to see Dr. Horace Williams, 1717 Pine street, Philadelphia, who dressed the burns on my hand. These burns healed very slowly but I have not felt in any way any of the after effects from this shock such as are usually felt from high tension direct current machines.

I am familiar with arc-light currents, and have received in my business many severe shocks, and I feel sure that had I received this kind of a shock from a direct current machine of any of the ordinary types * * * that it would have been fatal.

I have worked with the alternating current both on the primary or high tension wire and the secondary or low tension wires, and am familiar with the placing of converters in different situations throughout buildings, and when placed as they are placed in Philadelphia, under a proper set of rules, such as the Board of Fire Underwriters have approved in Philadelphia, I do not see how any one can be hurt on the secondary wires, as in case of any accident the safety fuses in the high tension wires melt out immediately, and I think that the high tension wires, when properly boxed in, are a great deal safer than arc light wires can possibly be. And further deponent saith not.

(Signed) W. L. WRIGHT.

Sworn and subscribed to before me this 7th day of July, A. D. 1888. THOMAS D. SIMPSON, Notary Public.

Other affidavits to the same effect were presented, signed by John Klepper, Benjamin Acker, Albert Schmid, George Fulton, John Schwartz and C. J. Thompson.

At the request of the Board, Mr. T. Carpenter Smith

explained the underground system as used by the Westinghouse Company in Pittsburgh, and in reply to an inquiry by Commissioner Gibbens, said that he considered the subways in New York superior to those used elsewhere in this country. He then dissected a Westinghouse converter for examination by the Board, to show that the statements made by Mr. Brown as to its insufficient insulation were erroneous. President Hess then called for the opinion of Mr. H. P. Brown, or any other person who desired to appear and argue against the introduction of the alternating system in New York City, but there being no person present who desired a hearing, the meeting was declared adjourned, subject to the call of the chair.

The Incandescent Lamp Suits in England.

Last week we published a special cable dispatch announcing the decision in England in the incandescent lamp suits. Further details, supplementing our exclusive cablegram, have now been received. The action respecting Edison's incandescent lamps was nominally, as readers of our regular English correspondence will remember, against Holland, who is at present managing an open-air resort called Albert Palace, situated at Battersea Park. A large building in the centre of the grounds is illuminated by electric lamps by contract with Jablochkoff and the General Electricity Company, Limited. The real defendants, however, were the Anglo-American Brush Electric Light Corporation, Limited, who have manufactured lamps for the Jablochkoff Company, at the same time guaranteeing the latter against legal proceedings. Justice Kay, in delivering the judgment, pointed out that previous to Edison's patent of 1879 it was well known that carbon was a good material for the purpose of making incandescents, owing to its being an imperfect conductor But until 1872, when Sprengel's air-pump was improved by Crookes, it was difficult to obtain a vacuum complete enough to prevent the carbon being rapidly consumed. Another difficulty which prevented the use of slender carbons was the irregularity of the current from the dynamo. This was remedied by the improvements of Gramme and Brush, which were perfected in 1878. On the 19th of December, 1878, Swan, in a lecture at Newcastle, described an experiment in the production of a current of electricity from a dynamo through a slender rod of carbon inclosed in an exhausted globe. The following January he lectured at Sunderland, exhibiting certain electric lamps. The next month he again lectured at Newcastle, and then exhibited the lamp which was produced in evidence. It consists of a bulb of glass with platinum leading wires sealed into it and connected with a pencil of carbon inside the bulb. The carbon was one-twenty-fifth of an inch in diameter, and, being straight, the leading wires were sealed into the bulb at opposite ends, thus rendering the carbon liable to be ruptured. But it would burn from ten to twenty minutes at a time without injury. The judge had no evidence to show how long it would last if continuously used.

In the spring of 1879 Swan ordered from Carré, of Paris, carbons of the shape of a hairpin, practically identical with the carbons now used. Lamps fitted with these would not have the defect referred to. Swan stated that, probably towards the end of 1879, he made some lamps with these, but the judge laid little stress on this as an anticipation of Edison, for he thought it fair to assume that these experiments did not succeed in producing a commercially successful result before the date of Edison's patent.

The judge proceeded to say that Edison applied to the object of producing a lamp of high resistance his untiring and apparently inexhaustible energy, but his specification showed he was not aware how much was actually then known on the subject. Edison availed himself of the more perfect vacuum obtained by the Sprengel pump, and also of the known principle of increasing the resistance of carbon by diminishing its sectional area. The judge said he had come to the conclusion that Edison's second claim was wide enough to include any lamp with a carbon filament however made. The only advantage of the filament was by reason of its small sectional area; but this described principle was published by Lane-Fox and Swan long before 1879. The judge held that Edison ought to have worded his claim so as to indicate the exact boundary between his filament and the Carré carbon, such as Swan successfully used. Moreover, the plaintiffs had been repeatedly challenged to prove that any lamp with a burner made according to the description in the specification had been brought into market in America or England. No system of electric lighting could be maintained with such lamps, except at a prohibitive cost. This explained why Edison never sold them. The judge proceeded:

"My opinion is that Edison's patent of 1879 is invalid, first, because the claim to a monopoly of incandescent lamps with a filament for a burner is too wide, considering how little Edison invented; secondly, because the specification does not describe the lamp which was commercially successful; thirdly, because the directions are so insufficient that nobody could make the carbons he describes without considerable previous experiment; fourthly, because one of the processes described as mixing carbon with a volatile powder, I believe, is practically injurious as Edison directs; fifthly, because coating with a non-conducting, non-carbonizing substance, if not injurious, is of no practical utility; sixthly, because the same may be said of coiling the filaments, on which the patentee lays great stress."

The action, so far as related to Edison's patent of 1879, was dismissed with costs, but the judge granted an injunction with costs against any infringement of the Cheesbrough patent.

Utilizing Water-Power.—Toulouse, France, is to have a new central electric lighting station, which will be operated by the Falls of Bazacle, from which power can be obtained up to 1,200 horse-power.

Gainesville, Ga.—A local paper says: Mr. T. F. Cronise, representing the Westinghouse system of incandescent electric light, has closed a contract with the Gainesville Electric Light, Heat and Power Company for the machinery and apparatus for 1,300 sixteen candle-power lamps. The plant will be put in by the Marr Construction Company, of Pittsburgh, Pa., and is to be in operation by Sept. 15 next. The Electric Light Company will enlarge their present building and will add a good deal of machinery, including new engines and boilers. This will be a great stride forward for the company.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, July 23, 1888.

The Board of Electrical Control.

The suit of the Board against the United States Company came up for hearing last week before Judge Gorman in the Essex Market Police Court, but no great headway was made and the next hearing will take place to-morrow. In the meantime the Board has received from Gen. Newton the opinion of Corporation Counsel Beekman defining the power of the Department of Public Works to remove electric and telegraph wires and poles under the direction of the Board. It says: "If after investigation you become entirely satisfied that these or any other poles in respect to which complaint may be made are what are denominated 'dead' poles, you should proceed to remove them. If you find yourself unable to arrive at this conclusion upon all the evidence you may be able to secure after diligent inquiry, you are not under any such obligation." Superintendent Richardson, of the Bureau of Incumbrances, says: "As far as this department is concerned we will now proceed to take down the dead poles and wires, complaints of which have been received through the Board of Electrical Control. If any trouble should arise the blame must rest with that body and not with the Department of Public Works. The Board of Electrical Control undertakes to notify the companies to which these poles and wires belong, and we are informed that in all about five hundred complaints are now tabulated. As the matter stands, if these are not removed now, the fault is ours. It is true that several companies have notified us that some of the poles and wires designated by the Board of Electrical Control as dead, are considered by them as a material part of their working plant, and threatening us with legal proceedings in the event of our interfering with them, but the opinion of Mr. Beekman gives us sufficient latitude to overcome such obstacles, and have the poles removed by the department at the expense of the companies. We begin the removals at once."

Courage Rewarded.

Lineman George Reid, of the Police Department, was presented last Thursday with a silver medal and $20 in cash by the New York Life Saving Benevolent Society for his courageous action in saving from drowning John Reynolds, a lad who had fallen overboard at the Battery on the 9th of June.

Cotton Leather Belting.

Mr. A. B. Laurence reports a large number of recent sales of patent cotton leather "Electric" belting, for electric light plants, etc., among the purchasing concerns being the Edison Phonograph Company, the Ocean Grove, N. J., Camp Meeting Association, Prospect House, Shelter Island; Elizabeth, N. J., Light, Heat and Power Company; Laconia, N. H., Electric Lighting Company; P. A. Dowd & Co., for a Sprague motor running in the office windows of the *Star* newspaper on Broadway.

Edison Plants.

Mr. C. J. Field, the active chief engineer of the Edison United Manufacturing Company, has just given me a complete list of their isolated, marine and miscellaneous plants installed up to May 1, 1888, showing a great many plants of 10,000 and 15,000 light capacity. The smallest is one of 15 lights, for marine use. The pamphlet shows 140 central stations and 1,200 isolated plants, bearing the name of Edison, having a capacity of 1,250,000 Edison lamps and representing a capital of more than $25,000,000. I understand that Mr. Field has put in thirty cash central stations this year.

Vetter Medical Batteries.

I was pleasantly surprised last week on calling upon J. C. Vetter & Company, of 214 East Forty-seventh street, to find that they had secured the main floor of that building, where they have been located for some years, and that they have installed a complete steam plant for the manufacture of their specialties in larger quantities. Their portable batteries for medical use have become well known, and they now propose to keep pace with the demand. Their batteries of all kinds for medical use are well made, and are extremely reasonable in price.

Brooklyn.

The Brooklyn Incandescent Electric Light, of 292 Graham street, have issued a neat little pamphlet giving their plan of work for furnishing light to business houses and residences, and stating that in future they will charge for the wiring at cost to the consumer and will furnish a 16 c. p. lamp at one cent per hour.

The Wessel Metal Company.

The above company, of 232 Canal street, are making a circular pocket gauge with the American standard wire gauge measurements, in all sizes from 0 to 36 and 5 to 36. These gauges are made of the company's special nickeline silver alloy by Brown & Sharp, and are warranted perfectly accurate, besides being superior to steel, etc., because they do not rust, oxidize or tarnish, and are able to resist acids, etc.

Electric Lamp Reflectors.

The Goetz Manufacturing Company, of 172 Mercer street, are making superior reflectors in all shapes and designs for electric lamps, of nickel plated and silvered metals. The goods have a high reputation in the market.

A New Power Station.

Mr. S. E. Hall, 211 Centre street, has installed and started his large electric power station at 83 Centre street. He has 75 h. p. of Edison dynamos, purchased through special agent Benton, and installed by Dowd & Co., the Sprague agents, who have already had such a run of orders for motors to be supplied from the station that its capacity is exceeded, and more generators will soon have to be put in.

An Active Agent.

Mr. W. McQuesten, the contracting electrical engineer, of 2 West Fourteenth street, now feels himself to be quite a New Yorker, and he finds his services in no less demand here in the East than they were in the West. He has lately been busy completing the Edison and American station at Paterson, N. J., and closed a short time since the contract for the Sprague road at Brockton, Mass. He now has work in view on a round dozen of central station and railway plants.

Straight Line Engines.

Williams & Potter, 2 West 14th street, are busy with Straight Line engines. They are installing two in the Stryker block at Ninth avenue and Fiftieth street, for a Westinghouse lighting plant to be put in by Mr. W. H. Cole. They are also putting in a 9 × 12 engine, with air pump, etc., for the United States plant on board the ferry boat "Maine;" one 7×12 for Mr. C. P. Huntington's Edison plant at Throgg's Neck, and will shortly start one in connection with the Sawyer-Man plant at Mr. Levi P. Morton's house at Rhinebeck on the Hudson.

The O'Keenan Battery.

The O'Keenan Electric Company, of 45 Broadway, this city are making a very interesting exhibition of electric lighting from primary batteries. Manager Perry states that he is making rapid progress in developing the interests of his company. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, July 23, 1888.

Fine Electrical Wire.

The Osborne & Cheesman Company, of Ansonia Conn., manufacturers of sheet brass, brass goods and copper wire, are making a specialty of fine electrical wire from No. 30 to 40. They also manufacture German silver resistance wire of various sizes.

Defeated by Two Majority.

About seventy-five voters attended the meeting held in the engine-house in Fair Haven, Conn., Tuesday night, July 17, to discuss the project of appropriating money for electric lights in the borough. Those in favor of the electric lights were thirty-six in number and those opposed thirty-eight. After the vote had been declared, quite a number of those who voted against the lights appeared to regret their action and said that should another opportunity be afforded they would vote in the affirmative A motion to adjourn for one week was defeated and the meeting was adjourned without day.

Injunction Obtained Against Lighting Wires.

The Southern New England Telephone Company has obtained an injunction restraining the Norwalk & South Norwalk Light Company from further erecting wires and poles in such a way as to cause induced currents on the wires of the telephone company. If the terms of the injunction are not complied with, damages amounting to $5,000 will be demanded. The telephone company has also obtained an order for a hearing on a petition for an injunction to restrain the electric light company from operating its present plant, where the lines of the telephone company are injured by induced currents.

Sprague Motors in Boston.

Among the numerous orders for electric motors recently filled by Messrs. Sawyer & Blake, of Boston—New England agents for the Sprague Electric Railway and Motor Company—has been one for the Boston Stock Exchange.

The Incandescent Radiator.

This meritorious and serviceable adjunct to incandescent electric lighting is beginning to be appreciated, and consequently the demand for it is growing steadily larger every day. By its use the glare of the light is overcome, and it is claimed that a gain of from 20 to 25 per cent. in diffusion of the light is obtained. The Hartford Dynamic Company, of Hartford, Conn., is selling very attractive cut glass and pressed glass radiators made in sizes that can be adjusted to all sizes of incandescent lamps, with fitters to each that render them adjustable to any size or shape of socket.

The Electric Road for Lynn, Mass.

On Tuesday evening, July 17, the Mayor and Board of Aldermen of Lynn, Mass., held a special meeting. An interesting hearing was held on the petition of the Lynn & Boston Railroad Company for leave to operate its proposed belt line through the Highlands by electric motor. Mr. Joseph F. Harman appeared for the residents of Rogers avenue in objection, the latter being to the erection of poles which might deteriorate the value of property on the avenue. If the construction of the line was to be of an ornamental character, he did not know that he or those he represented would object. President Breed of the railroad company explained what it desired. Mr. Boland, an electrician, spoke of the efficiency of electric motors. There were 28 cities that had adopted them, and 51 other cities were considering the feasibility of adopting them. The report of the committee that the electric motors should be allowed under certain provisos was unanimously adopted.

Inspection of Boilers.

It is said that 261 boilers disastrously exploded in this country during the year 1887. Various electric light companies are among the list of sufferers. Probably ten to twenty times that number of boilers were disabled by accident an small magnitude that a thorough systematic inspection would have prevented. While the character of the indemnity offered by the Hartford Steam Boiler Inspection and Insurance Company is undoubted, one of the greatest advantages offered by that company is a feeling of security from a knowledge that the boilers, their fittings and attachments are carefully inspected before a policy is written, and periodically thereafter. Its policies cover all loss or damage to property, loss of life and personal injury caused by rupture or explosion.

The Gelatine Battery.

The H. B. Cox Electric Company, of New Haven, Conn., have just issued a circular as to the results obtained with their gelatine battery, which has already been described in your columns, and is now a familiar appliance, peculiarly cleanly, portable and convenient. Among the testimonials is one from Mr. W. C. Smith, the superintendent of fire and police telegraphs at New Haven, and who has used the battery on the police signal boxes of the Brewer and Smith signal system, the Gamewell police telephone system, and the fire department telephone service, since October, 1886. He says: "They have given perfect satisfaction. I have used them in the signal boxes without, covering or protection

of any kind from either heat or cold and they have required no attention or renewal of parts whatever, those longest in use doing their work as well to-day as those more recently put in use." He votes them to be the best batteries in existence for their class of work.

An Enterprising Firm.

Messrs. Blodgett Brothers & Co. manufacturing electricians, 388 Federal Street, Boston, Mass., have been awarded the contract for wiring Hotel Beacon for 700 incandescent lights, a 150 call annunciator and other electrical apparatus. This well-known firm have just completed two other creditable installations, respectively, at the Woodland Park, Mass., Hotel, and at the Lasalle Seminary at Auburndale, Mass.

The Fire Alarm at Marblehead.

Advices from Marblehead, Mass., under date of July 20, state that the board of engineers has closed a contract with the Game well Company to extend the fire alarm throughout the town, with a striker at Abbot Hall and figure indicators at each engine house. Work will begin at once, and the cost will be about $2,500.

Personals.

Lieutenant Weaver, of the U. S. Navy, whose name—as a contributor of several scientific and interesting articles to this paper—is familiar to your readers, favored this office with a visit last week.

Mr. Walter S. Kelly, of Lowell, Mass., has accepted a position with Messrs Sawyer & Blake, New England agents of the Sprague Electric Railway and Motor Company.

Mr. J. H. Findlay, proprietor of the Malone and Ogdensburgh (New York) Gas Companies, was in Boston last week and was a visitor at the rooms of the Boston Electric Club, the guest of Mr. W. J. Morrison, the special Northern agent of the American Electric Manufacturing Company. Mr. Findlay has gone into electric lighting in connection with the Ogdensburgh (New York) Gas Works and has recently purchased a 135 arc-light plant, American system. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., July 21, 1888.

Atlantic City.

A special dispatch from Atlantic City, N. J., says: For some time past there has been a great deal of interest manifested in the project for propelling the street cars on Atlantic avenue by electricity, and it was expected that an ordinance granting the Camden & Atlantic Railroad Company, which owns the tracks, the privilege of erecting poles and stringing wires for the overhead system of electrical traction, would be considered at the meeting of City Council last evening. The ordinance, however, was not called up, and the only way in which the subject engaged attention was in the presentation of a numerously signed petition in favor of the overhead system. At the next meeting of the Council it is expected that the ordinance will be brought up for consideration, if not for final action.

Public sentiment is far from being altogether in favor of the system of the overhead electrical wires. Many of the most influental residents, who have large business interests at stake, believe that a storage motor of some sort would be preferable, and they advocate sufficient delay in the matter to afford an opportunity to test some of the electrical motors which are based on the storage battery system.

Lebanon, Pa.

A telegram from Lebanon, Pa., says that Judge McPherson has rendered a decision in the case of the Berks & Dauphin Turnpike Company against the Lebanon Electric Railway Company, which if it stands will prevent the building of the contemplated street railway, at least until the law can be changed. A preliminary injunction was asked by the plaintiff to restrain the defendant from building a street railway on Cumberland, on the ground that it would destroy the franchises of the plaintiffs. It was at first refused, but afterwards granted on the ground that the act under which the railway company was chartered was unconstitutional as being special legislation. In the opinion, the judge expresses his sincere regret at the checking of a needed public enterprise, but suggests that the only way out of the dilemma is new legislation upon the subject.

Washington, D. C.

The Interior Department has purchased, and is now putting in place, a Brush electric light plant capable of furnishing 800 lights. The plant will cost about $10,000, and will be operated by department employés. The cost of lighting the department building has hitherto been about $500 per month; $200 for gas, and $300 for electric lights furnished by a local company. It is expected that under the new system the cost of lighting will be reduced more than one-half.

Hagerstown, Md.

A most successful start was made by a Schuyler plant located at Hagerstown, Md., on Saturday last. The station is a new brick building built for the purpose, located on the line of the Baltimore & Ohio Railroad, from which a spur has been laid to facilitate the handling of coal and other freight. The station is provided with a Taylor Manufacturing Company steam plant, consisting of two 125 h. p. automatic engines and two 150 h. p. boilers. These engines are marvels of beauty and strength. The electric equipment comprises two 45 arc light Schuyler dynamos, with 60 improved double carbon street lights, which are all suspended in the centre of the streets. A five years contract has been granted. In addition to this there are a large number of commercial lights, with all the latest improvements in automatic regulation, etc., at the central station. A 1,300 light incandescent plant is to be added at once and a large increase in the arc lights is assured in the near future. The city authorities speak in the highest terms of the light and pronounce it an unqualified success.

Engine Sales for Lighting.

Mr. J. W. Parker, of the house of Thomas P. Conard, has contracted with the Atlantic City Electric Light Company for a 150 h. p. Ball engine, and has also put in the station a 100 h. p. engine of the same make, which is now running 100 American arc lights. The 150 h. p. engine, when in operation, will carry 200 lights of the same make of 2,000 c. p. each. The American Electrical Construction Company, of New York, have also signed a contract with Mr. Parker for a 100 h. p. steam plant complete, for the running of 100 arc lights, which are to be in operation by Sept. 1.

Easton, Pa.

A dispatch from Easton, Pa., says that the suits begun by the owners of the brownstone fronts on North Third street, to prevent the Traction electric railroad from passing through that avenue have not stopped the work. The sills and stringers are now down the entire length of the street, and the laying of the rails will be begun at once. A movement is also on foot to extend the electric railway out on Fourth street to the New Jersey Central depot.

Baxter Motors.

Mr. H. A. Cleverly is doing an enormous business as the agent for the Baxter motors. A large number have recently been put up. The greatest obstacle to the sale of a much larger number is the inability to secure day currents from the electric light companies. When this can be secured business will "boom." Messrs. J. W. Queen & Co. run their factory with a 4 h. p. Baxter, which gives great satisfaction. Mr. Cleverly has also secured the agency for the Eco magnetic clock, and expects to do a large business in this line, especially since the clock has the hearty indorsement of the Associated Factory Mutual Fire Insurance Companies, which organization pronounces it one of the best watchmen's clocks in existence. E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, July 21, 1888.

Chicago Electric Club.

The meeting of the Chicago Electric Club which was to have been held Monday evening of this week was adjourned until July 30.

The Sprague Electric Railway and Motor Co.

moved this week into new and pleasant quarters on the ground floor of the new Rookery building in the rotunda. This building, which is located on the corner of La Salle and Adams Sts, is conceded to be one of the finest office buildings in the West, and the offices of quite a number of electric companies are located there. It will be remembered that a description of the electric light installation of this building was given in THE ELECTRICAL WORLD a few weeks ago.

The Elmer A. Sperry Co.

The Elmer A. Sperry Co. was organized during the past week. The company will, I am informed, commence at once the manufacture, under the Sperry patents, of a large line of electrical specialties, supplies, etc., besides doing a repair business. Motors, automatic switches, etc., will be among the articles manufactured. The factory, which is nearly completed, will be finely fitted up in all respects with machinery, etc., and will be located on the corner of Clinton and Van Buren streets.

An Elevated Road Model.

Mr. Forée Bain, the electrician, is building a model of the Hanna Elevated Road for exhibition purposes. This system proposes to use storage batteries to generate the motive power.

Colorado News.

Recently Colorado has taken quite a stride in electrical matters, and no branch has been more vigorously pushed than that of electric lighting. Mr. H. H. Brown, of the Thomson-Houston Electric Company, seems to be the champion agitator. Among his recent installations are the following, all of which show a healthy growth: Canon City, 60 arcs; Pueblo, started with 45, has since increased to 240 arcs, and is now planning for 1,200 incandescent increase; Manitou Springs, 30 arcs and 1,000 incandescents; Colorado Springs, 100 arcs; Boulder, 400 incandescents; Trinidad, 105 arcs. Mr. Brown is at present constructing a plant of 150 arcs in Denver, which, when completed, will make a grand total of 690 arcs and 1,400 incandescents placed in Colorado by him since assuming the agency of the Thomson-Houston Company. With the electrical apparatus have been placed nine Ball engines and boilers, aggregating 1,000 horse-power. The construction has been made under the direction of Mr. Charles H. Brown. The Denver plant is to occupy a lot 133 feet by 133, and so arranged that it may be increased at any time without affecting the present building or service.

Miscellaneous.

Mr. C. S. Rusling, manager of the Kansas City, Mo., branch of the Thomson-Houston Co., was in the city this week. He reports the electric outlook very bright in his section.

The Central Electric Co. are putting on the market a new wire of very high insulation, which they call the "Improved" Candee, which they regard as much superior to the Candee Aerial, whose merits are already well established. This wire differs from the old in first being wound with a tape, then with a braid, and then saturated with a compound, which makes it entirely water and weather proof. The former wire was simply wound with braid, and then saturated. The company look upon the higher insulation as being in every way superior. They already have received some large orders for it. Good-sized orders for other specialties manufactured and sold by the company are being received, among which may be mentioned one large order for carbons.

The Solar Carbon Company.

C. B. Curtis, Western agent for the Solar Carbon Company, has removed his office to 175 Randolph street, where he will have headquarters with the Electrical Construction Company. He will act as agent for the Electrical Construction Company, in connection with his other business.

The Electrical Supply Company.

The Electrical Supply Company report sales of the popular P. & B. wire very brisk. Among recent orders reported by the company was one of a shipment of two carloads of this wire of the various sizes. They also report recent large sales of Kerite wire and armored cable for submarine work. I also learn that the demand for the blue vitriol, sold by the company, is, just now, rather in excess of the supply, although they receive the entire output from a local refining company, a fact which evidences the quality and price.

Thomson-Houston Company.

The Thomson-Houston Company, among recent sales, report the following: 85 2,000-candle power arc lights to Columbus Electric Light and Power Company, Columbus, O.; 50 1,200-candle power arc and 300 incandescent lights to the Helena Electric Light Company, of Helena, Mont.; 150 2,000-candle power arc lights to the Findlay Electric Light Company, of Findlay, O.; also 1,000 incandescent lights to increase the Kansas City plant at Kansas City, Mo.

Matchless Metal Polish Company.

The Matchless Metal Polish Company, manufacturers of the Tripoline metal polish, report an increased demand for their goods among electric light companies, a fact which in itself goes to substantiate the claims of superiority set forth by the company. The polishes made by the company are rapid cleaners of all kinds of metal, and, being free from acid, as it is claimed, make just the thing for cleaning carbon tubes.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150	@ $155	Iowa Union	$27	@ $28
Central Union	47	@ 48	Michigan	79	@ 80
Chicago	350	@ 375	Missouri and Kansas	70	@ 71
Colorado	19	@ 21	Rocky Mountain Bell	40	@ 45
Cumberland	65	@ 68	Wisconsin	110	@ 112
Great Southern	35	@ 40			

E. L. P.

KANSAS CITY, MO., July 14.

The Telephone Situation.

Interest in electrical matters in Kansas City remains centred in the proposition of the city to reduce the income of the telephone company and at the same time increase its expenses. It is proposed to reduce the income by cutting the rates from $72 to $50; to increase the expenses by having the poles removed and the wires placed underground. Of course the city is not a unit in this matter, and the telephone company will be a unit in opposing it, and will have the energetic assistance of all the other electrical companies in the city and the moral support of the other franchise corporations—the street car companies for instance. The proposition to reduce the rates is the outgrowth of the St. Louis agitation. The Mayor was completely won over, and addressed a communication to the city council, calling the attention of councilmen to the complaint against the rates and the desire that the council should pass a reduction ordinance. In his communication the Mayor stated that it was his belief that the telephones could be furnished for much less than the present rates. He requested the council to investigate the matter and pass such ordinances as suggested. He also submitted a communication from A. C. Hawley, an official of the "Interstate Telephone Manufacturing Company," stating Mr. Hawley's willingness to organize a company which would furnish telephones for $50 a year. City Counselor Quarles has also been won over in a legal way and gives it as his opinion that all the city has to do is to go ahead and pass an ordinance reducing the rates and they would be reduced. "You see," he said, "the council granted the telephone company the franchise to build its lines along certain streets. Hasn't it the right to regulate that franchise? Suppose it hasn't, can't it grant a franchise to some company that will put its figures down within the popular reach?" But the telephone company still thinks it holds the winning hand. "We are not worrying over the matter," said Superintendent Smith, "I have not talked with the mayor, the city counselor or any other city official in regard to it nor do I intend to unless they come to me. We cannot operate our lines any cheaper than they are at present, therefore could not stand a reduction. Even if the city should find that it could legally regulate our rates it must be borne in mind that we are not far from the State line, and the city certainly could not prevent us from locating our central office in Kansas, and contracting with subscribers over there. There is nothing in theory to prevent another company from occupying the field in case we should abandon it. But there are three facts that oppose it. One is that the new company would in all probability be unable to secure the Bell instruments; another is that in case they did get the Bell instruments, capitalists are not going to put money into a new plant that would promise so little as a telephone company in Kansas City under the proposed reduced rates; a third is that if the company did not secure Bell instruments, it would find itself a defendant (the moment it attempted to use any other instrument) in a bitter and unyielding suit for infringement with one of the strongest and richest companies in the world, the Bell Telephone Company, as plaintiff. If we are compelled to abandon Kansas City there will be great delay and confusion in the telephone business before a new system is as satisfactory as ours. If, in spite of all these difficulties, a new company could succeed us here and meet the wants of the city, why let it. It would be a miracle."

Miscellaneous.

The American Electric Light Company is again enlarging its station, and this time it is putting in two 50-light machines.

Mr. C. S. Rusling, of the Thomson-Houston agency, has been in Fort Scott, Kan., during the past week.

Mr. Vitales Himmer, representing Gassner's dry battery, of New York, was in the city last week.

SOUTHERN NOTES.

DALLAS, TEX., July 14, 1888.

A New Edison Agent.

William T. M. Mottram, formerly general superintendent of the Edison Company at New Orleans, has been appointed general agent for the Edison Companies in the State of Texas, and will make his headquarters in Dallas, having already entered upon his labors. Mr. Mottram possesses a thorough knowledge of the business, both electrical and mechanical, and is the first able representative the Edison Companies have had in this vicinity.

Cleburne, Tex.

Cleburne, Tex., has emerged from its long-continued obscurity, the electric light plant having been started on the evening

of June 30 with the most flattering success, the Thomson-Houston system being employed, using both arcs and incandescents. The citizens are delighted with the light as well as with the entire construction of the plant. Mr. F. O. Richards, of the Thomson-Houston Company, and Mr. Owen J. Cook, of Cleburne, deserve great credit for their efforts to make the plant a success.

Baxter Motors.

Mr. F. R. Colvin, representing the Baxter Electric Motor Company, has returned to Baltimore, after having made a thorough canvass of the State in the interests of his company. He reports unusual activity in the motor field, and says that the Baxter has distanced all. It is to be hoped that Mr. Colvin will again favor Texas with a visit.

Lighting in Dallas.

The Queen City Electric Light Company has not yet awarded the contract nor decided what system to use, the various companies having their representatives on the ground, and considerable rivalry exists among them.

Belton, Tex.

Mr. Nelson K. Smith, the electrician in charge at the Baylor Female College, at Belton, Tex., has been visiting in Dallas. He is very enthusiastic over the success of the 300-light Edison plant recently put in the college by Messrs. Clower & Harris, of Dallas.

San Antonio, Tex.

The Electric Light and Power Co., of San Antonio, Tex., report business unusually good. They certainly have adopted a novel method of securing customers. They offer to furnish 16 c. p lights on yearly contracts to present gas consumers at the rate of $2.25 per 1,000 cubic feet, last year's bills being taken as a guide. As gas is now $3 per 1,000, they certainly ought to have patronage.

The Heisler Company.

The Heisler Electric Light Company are meeting with great success with their new arc lamp that is especially gotten up to burn on their incandesent circuits.

The Fort Wayne System.

C. S. Knight, representing the Ft. Wayne Jenney Electric Light Company, has returned to Ft. Wayne after an extended trip through the South in the interest of that company. He expresses himself as very much pleased with the outlook; he has secured a number of large orders for his company.

Pan-Electric Goes Up in Smoke.

The last sad act in the tragedy of the Pan-Electric Telephone Company in Texas was performed a few days since, when the thousands of transmitters and receivers taken from the numerous exchanges throughout the State were hauled to the dumping grounds north of the city and consigned to the flames. Messrs. Knight and Fish, of the American Bell Telephone Company, were present and officiated as executioners.

CANADIAN NOTES.

MONTREAL, Quebec, July 14, 1888.

Incandescent Lamp Litigation.

Since my last letter, the Royal Electric Company have answered the action of the Edison Company by a general denial. They state they have not manufactured any lamps in Canada, and that they import the Sawyer-Man lamp from the States, where it is a marketable article. They also state they have never promised to pay the Edison Company any moneys whatever.

Some days ago a telephone set was burned out in Ottawa. Several such occurrences have taken place there of late. One of the local electricians (?) in speaking of the occurrences states the damage was done by the "wild" electricity, such as used by arc light companies, and that the "tame" electricity used by the incandescent company is harmless. This definition of the qualities of a current may interest some of our junior electricians. With the progress of the age our ideas should develop. Such is not the case it seems with the hardy outside man whose duty it is to trim the arc lamp. So often do we hear of foolhardy carelessness in linemen, or lamp trimmers, that one incident here or there hardly stirs any sentiments of pity within us, but one rather of indignation that such men are allowed to come into the business. At Halifax, some time ago, a lamp-trimmer climbed a pole to trim the lamp. The current, it seems, was on. By carelessness, we will assume, he took hold of both wires and was instantly killed. The next day, or day after, a second man was in like manner killed. They thought they knew all about it. It is said, and, if it is true, to be unconditionally condemned, that the electric light company are running some 90 lamps and about 4,000 volts on this circuit, by reason of which they save the wire necessary to divide the lighting into two circuits. Such economy is criminal in the extreme.

Too much stress cannot be put upon the necessity of water-proof insulation. I think I am safe in saying that had the above circuit had some water-proof insulation, two lives would have been saved in spite of the carelessness exhibited on the part of all concerned.

Police Patrol at Toronto.

The City of Toronto has a complete system of police patrol, installed by the Bell Telephone Company. The system was only recently inaugurated and is pronounced a success in every way.

Five Hundred Miles in a Buggy.

Mr. C. F. Sise, vice-president of the Bell Telephone Company, accompanied by Mr. Hugh Baker, of the Western Division, recently made a 500-mile drive in an open buggy, inspecting the lines of the company. Both have returned much improved and browned by exposure.

Electric Lighting.

In electric lighting, Ahearn & Soper, the agents for the United States system, at Ottawa, have added a 500-light machine to their central station there, making four machines in all. The Edison Company report an increase of two No. 10 machines in the Victoria central station, B. C., an installation of 460 lamps for the Canadian Pacific Railway at Vancouver, B. C.; 160 lamps in the Jencks Machine Company's Works, Sherbrooke, Quebec, where are located the Canadian works of this company. Mr. M. D. Barr, who is the general agent, reports a contract for wiring the Grand Trunk Central station for 760 lamps. The Royal Electric Company report an installation of 500 lamps in the St. Laurence Sugar Refinery, Montreal; 150 lamps in the *Herald* building, Montreal; 100 lamps in the Canadian Pacific shops, Montreal.

The Subway Commission.

The subway commission recently appointed to visit American cities have returned very well pleased with the manner in which the underground work has been done in the various cities visited by them. They express themselves as adverse to the adoption of a system of subways in Montreal because of the cost and the difficulties to be encountered in opening the man-holes in winter on account of the deep snow.

Canadian Inventions.

Mr. Hugh Neilson, the local manager for the Bell Telephone Company at Toronto, is an old-time telegraph operator, and recently attained considerable local distinction in Walkertown, where they have just learned of the 'Quad.' The old time telegraphers will remember Toye's repeater and Neilson's improvement on the same. The Walkertown paper, after giving Mr. Neilson credit for an invention "now in general use" in the Dominion and the States, claims Canada as the native place of the inventors of the quad, the telephone and electric light. The assumption of some of the natives of the suburbs of the States is astonishing.

Telephony at Brantford.

While in Brantford a few weeks ago, I was regaled by a short history of the connection between that place and Professor Bell. It seems that Professor Bell's father lives in Brantford, and because of the celebrity thus acquired, the good citizens think they should be specially favored in regard to telephone service. Mr. Hugh Baker, the manager of the Western division of the Bell Telephone Company, has been besieged by many a worthy citizen endeavoring to convince him of this fact. Professor Bell's father had at one time the agency for the Dominion, and was succeeded by the Bell Telephone Company. The fire alarm at Brantford, as in many another place in Canada, is composed mainly of the telephone system. Not long ago a fire occurred, when an excited individual bethought him of a neighbor's telephone, and forthwith hied himself to this neighbor's house, and, rapping on the door, awaked him. The neighbor, on thrusting his head out of the upper window, was hailed with, "There is a fire in the boarding-house; please telephone the fire department." Hurrying to the telephone the obliging neighbor gave the message to the fire department. Then came back in stentorian tones: "What boarding house?" The man with the fire in his house had, of course, disappeared, and before the department had located the boarding house the building was burned up. This is on par with the department at Appleton, Wis., composed of Germans, who sent by mistake the fire machines east when it should have gone west, and while they were hunting the fire the building was consumed.

A Swindling Operator.

A telegraph operator with a German name has been "operating" here quite successfully. His success was remarkable Having obtained credit to the amount of $500 from various parties for wearing apparel, etc., he has returned to New York to enjoy the proceeds of his venture.

MT. ROYAL.

ENGLISH NOTES.

LONDON, July 11, 1888.

Gaulards-Gibbs vs. Ferranti.

On Tuesday, July 3, Mr. James Swinburne, Professor Adams and Professor G. Forbes were called by the plaintiffs. Professor Adams' evidence went to show that at the time of the electrical exhibition at the Crystal Palace in 1882, nothing approaching the Gaulard-Gibbs system was exhibited. Mr. Swinburne and Professor Forbes gave evidence with regard to the extensive use of transformers in the United States, and in cross-examination admitted that in practical use the connections of the primary wires were always made in parallel. Mr. John H. Gibbs, one of the patentees, was submitted to examination and testified that they had competed for the prize offered in 1884 by the Italian Government for the best system of distributing electricity. They had worked their generators upon a circuit 50 miles in length, and were awarded the prize, consisting of a gold medal and £400 in money. On Wednesday, Sir Horace Davey addressed the Court on behalf of the defendants. He pointed out that a very considerable difference existed between the terms of the original and the final specification. In the provisional specification it appeared to be the intention of the patentees to claim the construction of the coils; but in the final form this claim was abandoned, and it was attempted to widen the patent so as to include every system in which an alternating current of high tension was employed for the generation of induced currents in coils placed at intervals upon the primary circuit. He should endeavor to prove to the satisfaction of the court that the system was hopelessly old when this patent was granted in 1882. He would show that there was no novelty in the use of an induction coil containing a core of iron wire, and that the method of winding the coil so as to produce high or low tension in the secondary, as might be required, was perfectly well known to every competent electrician at that date. The mere fact that the patentees claimed the use of an alternating current of high tension without claiming any specific mode of producing such currents, while there were already in existence numerous alternate current machines capable of being constructed so as to give a current of any required tension, was a claim of an entirely inadmissable character. The first specification to which he should call the attention of the court was that of Jablochkoff, which was published as long ago as 1877, and contained every feature which was necessary to effect a successful distribution of electricity by means of induction coils. In the following years specifications relating to systems which were of a perfectly identical characters were filed by no less than five different patentees, namely, Mr. C. W. Harrison, Sir Charles Bright, Messrs. Edwards & Normandy, Mr. J. B. Fuller, of New York, and M. de Meritens. It might be asked, how was it, if this plan was so well understood in 1878, that it had not come into general use for four or five years later? The simple reason was that these inventions were before their time. At that early date there was no practical incandescent lamp in existence, and there was no demand for the distribution of electricity upon so extensive a scale. If the wide-sweeping claims of Messrs. Gaulard & Gibbs were to be upheld, he would venture to ask his lordship what would be the position of any one of the earlier patentees whom he had named, were they to attempt to work their system in this country (his lordship interpolated a remark that he trusted in that event that the case would not come before him). At the conclusion of Sir Horace Davey's address, Sir William Thomson was placed in the witness box. He stated that the induction coil was a very old instrument, and for years before 1882 it had been made with wire cores. In 1882 it was perfectly well known how to regulate the quantity and tension in the induced currents. He was unable to find anything in the patents of the plaintiffs which was not disclosed in earlier patents which had been brought under his notice. He would not say that every one of the earlier patentees described a system which could be placed at once upon the market without modification, but neither did he think that that could fairly be said of the plaintiffs' specification. The necessity for using high tension in order to carry electricity to a considerable distance with reasonable economy was perfectly understood before the time of Messrs. Gaulard & Gibbs. The relation between the number of turns in the primary and secondary coils was perfectly well known to Faraday, and although Mr. Gibbs had referred to it in his evidence, he found nothing in the specification relating to that point. In cross-examination Sir William Thomson admitted that in an address to the British Association at York in 1881, on the distribution of electrical energy, he had suggested that the best means of solving the problem might probably be found in the employment of secondary batteries. It was perfectly true that at that time he did not realize the advantages to be obtained by the employment of induction coils or secondary generators, but this did not affect his contention that no principle was involved which was not a matter of common knowledge at the time referred to. At the conclusion of Sir William Thomson's evidence the judge intimated that he did not think it necessary that he should hear any further scientific evidence; consequently, the case for the petitioner was brought to a conclusion after a few formal questions had been put to Mr. Ferranti, Dr. Fleming and Major-General Webber. Mr. Moulton, in summing up the case for the petitioner, delivered a powerful speech in which he strongly urged that there was nothing in Messrs. Gaulard & Gibbs' specifications which had not already been fully described by their predecessors; moreover, it was impossible from the patent as it now stood for any manufacturer to find out exactly what it was and what it was not permissible for him to do. Mr. Aston in his speech on behalf of the patentees admitted that in the amended specification they did not claim the specific construction of any particular form of induction coil, but what they claimed was the employment in combination of a high tension alternating current dynamo with an induction coil having a divided core and so wound that the difference of potential at the terminals of the secondary was less than that at the terminals of the primary. In delivering judgment Mr. Justice Kekewich confined his attention almost solely to the point upon which Mr. Aston had dwelt, and stated that when a patent was based upon a claim for a combination of known parts it was all the more incumbent upon the patentee to set forth in explicit terms exactly what it was which came within the limits of his invention. This he held that Messrs. Gaulard & Gibbs had failed to do. In its original form there was a specific claim for the construction of a particular kind of inductional coil, which he should have held to form a valid patent. The operation of the disclaimer, however, struck out the only portion of the specification which in his view was good. The claim for the combination of a high tension alternate-current dynamo with a transformer could not be admitted, upon the ground that the patentee had not set forth what were the features of the transformer which he proposed to employ. It was alleged that the use of a wire core would constitute infringment, but although it was true that the specification contained the description of two types of transformers each containing iron-wire cores, yet it was nowhere specifically laid down that such a core formed an essential part of the combination. Precisely the same remark applied to the contention that the coils must be wound so as to produce a lower potential at the terminals of the secondary; this was nowhere specifically stated. On these grounds he delivered judgment annulling the patent. This decision can surprise no one who was present in court during the hearing of the case, or who has followed the published account of the proceedings in the technical press. It early became evident that from a legal point of view the claim set up on behalf of the plaintiffs to a monopoly of the system of distribution by inductional transformation was utterly untenable. The original specification had already been amended in such a way as to disclaim the construction of secondary generators of any particular pattern. The sole object of this disclaimer was to strengthen the contention that the patentees were entitled to a monopoly of the system itself. Since the specific construction set forth in the original specification no longer entered into the claim, it became necessary to show that the invention consisted in a combination of known parts, in which combination either the plaintiff's induction-coils or those of previous inventors became an integral portion. In the words of the judge the patentee "does not claim to *construct*, but he requires to *use* certain instruments, and those only when constructed." The exact bearing of this contention is admittedly obscure, and it was in virtue of this very obscurity that the plaintiffs lost their case. I learn, however, that an appeal is to be lodged against Mr. Justice Kekewich's decision.

Leamington Lighting.

I have recently paid a visit to Leamington, a town which enjoys the distinction of being lit, so far as its principal streets are concerned, by incandescent lamps. You will perhaps remember that a good deal of adverse comment has appeared in connection with this installation. I must confess that I am unable honestly to state that the street lighting is a success. The lamps were certainly not well up to candle-power, and the same amount of money expended in gas lighting, or, still better, on arc lights, would undeniably produce a far better effect. With regard to the alleged failures at the central station, it appears that although

there were some serious difficulties in connection with the insulation of the mains during the first six months' working yet the installation has been run entirely without mishap since December last. The house lighting seems to give complete satisfaction.

What Shall We Read.

Mr. T. D. Lockwood's interesting article, which recently appeared your columns, on the question of "What Shall We Read?" has met with much appreciation here, and extracts have been reproduced in several technical journals. Mr. Lockwood's selection certainly appears to be a very judicious one. The only exception of note is that of Kempe's "Handbook of Electrical Testing," which is universally acknowledged as the standard work upon the subject in this country, and is recognized by the Postal Telegraph Department (with which Mr. Kempe is connected) as the text-book for their technical schools. I may add that a new edition of this book appeared last year, in which tests suitable for electric lighting installations are included.

THE TELEGRAPH.

The Old Timers and the Military Telegraphers meet at Chicago on Aug. 15 and 16.

New Mexico.—The New Mexico & Texas Telegraph Company, of El Paso, Tex., has been incorporated.

Troy, Ala.—The Troy Telegraph Company has been formed, and will build its lines at once. Mr. L. M. Bashinky is president.

Not Buying Cables.—The rumor that Mr. Jay Gould had bought the commercial cables from Mr. J. Mackay for $11,000,000 has been officially denied.

Boston Police Signals.—The Boston Board of Police has issued orders providing for the management of the police signal service, and appointing as director of signal service Lieut. Henry O. Goodwin.

Milwaukee, Wis.—The work of digging manholes for fire and police underground conduits was begun at Milwaukee on July 10, being the first step toward a complete underground system throughout the city for all police and fire alarm wires. It is estimated that the work will cost $12,000 before completion.

Mutual Union Bonds.—Arrangements have been perfected providing for an exchange at par of bonds of the Mutual Union Telegraph Company and stock of the New York Mutual Telegraph Company for collateral trust bonds of the Western Union Telegraph Company. This exchange can be made at the Mercantile Trust Company any time before August 15, 1888.

Interstate Telegraph Regulation.—A special dispatch from Washington, of July 18, says: Senator Platt was authorized to-day by the Senate Committee on Interstate Commerce o report back with verbal amendments the Spooner bill subjecting the telegraph companies to the jurisdiction of the Interstate Commerce Commission, and regulating their operations in much the same way as the Interstate Commerce Law regulates the affairs of the railroads.

THE TELEPHONE.

Beats the Telegraph.—Messrs. Richardson, Hill & Co. have added a second long-distance telephone to their New York facilities. In very bad weather banking houses have to depend upon their telephone wires for direct New York connection. They are declared superior for telegraph service to regular telegraph wires.—*Boston Herald.*

Another Perpetual Injunction.—At Parkersburg, W. Va., on July 18, Judge John J. Jackson decided in the United States Court the case of the American Bell Telephone Company against the Emner Telephone Company of Charlestown, W. Va., granting a perpetual injunction against the Emner Company, of which Bushrod C. Washington is President.

THE ELECTRIC LIGHT.

The Schuyler Electric Company, of Middletown, Conn., reports business rushing, several new contracts being now in the works.

Chicago, Ill.—The Western Electric Company have received the contract to light the exposition with 200 arc lights and 100 incandescents.

The United States Illuminating Company appeared in court last week before Justice Gorman to answer the complaint of the Subway Board in regard to its unburied wires. Evidence was taken, and the case was adjourned until this week.

Orange, Tex.—Lutcher & Moore, the proprietors of the large Star and Crescent lumber works at Orange, have put in a large Westinghouse incandescent plant, and are to light their yards with three arc lights. The enterprise is wholly their own.

New Orleans, La.—A special dispatch from New Orleans of July 17 reports the destruction by fire of the Brush-Westinghouse station there at a loss of $100,000, with an insurance of $51,500. The fire was started, it is said, by the upsetting of an oil lamp.

Louisville, Ky.—The Gaynor Electric Company, of Louisville, have put in a 75-light Sawyer-Man plant for the Beargrass Woolen Mills of that city, a 100-light plant for the Southern Woolen Mills, and a 400-light plant for the Phœnix Hill Brewery.

Pine Bluff, Ark.—The incandescent electric light plant lately mentioned will probably be erected by Mr. Thompson and others, of St. Louis, Mo., who will complete the water-works, as lately stated. They have purchased three dynamos.—*Mfrs. Record.*

Edison Patents in Canada.—A newspaper dispatch from Ontario states that steps will be taken by certain parties in Canada to annul Edison patents on electric lighting in the Dominion for alleged non compliance with the provisions of the patent law.

The Electric Appliance Company has been formed with a capital stock of $30,000 to operate the Doyle glass works at Phillipsburg, Pa., and to pay special attention to electric light glass ware. Mr. J. Sefton is president, Mr. A. Silverman secretary and treasurer, and Messrs. E. Kaye, E. Hughes, J. Huggins and F. Kalb, directors.

Carroll, Ia.—The Carroll Electric Light and Power Company, recently formed, has a capital stock of $25,000. The officers are: V. Hinrichs, president; F. W. Krause, secretary; O. A. Kentner, treasurer; H. W. Macomber, A. Gram, J. B. Hungerford, and the above, directors.

"Not the Same."—"A new electric lamp called the 'Gladstone' has just been put upon the market by the firm of Holmes, Booth & Haydens at Waterbury."—*Ex.*

We have seen the above lamp, and consider it altogether the best of its kind and likely to run all others out of the market. But it is not an electric lamp quite. It is simply an excellent oil lamp.

Lawrence, Kan.—Secretary Johnston, of Lawrence, Kan., writes as follows: The Lawrence Gas, Fuel and Electric Light Company is the old gas company under another name. We have about completed our electric light station, and will have 105 T.-H. arc and 500 Edison incandescent lamps. We have two 90 h. p. Ide engines and two 90 h. p. Leffel water-wheels. We use water-power, with steam as auxiliary.—*Lt., Ht. & Pr.*

Brockton, Mass.—The Thomson-Houston Electric Company, of Boston, has brought suit against the Edison Electric Light Company, of Brockton, Mass., operating the Edison municipal system of street lighting by incandescent lamps, for infringement of its patents on the film cut-out used by that company. The action is brought under the same patents as were cited in the similar suit begun recently against the local company at Fishkill, N. Y., operating the Heisler system.

Millersburg, O., was lighted by electricity for the first time Saturday, July 14. The populace thronged the streets, and numbers of people from surrounding towns were present to witness the advent of the arc light, which has been installed by the Schuyler Electric Company. Mt. Vernon people were interested spectators of the event, being drawn thither by the fact that they are shortly to enjoy the same pleasure at home, the Schuyler Company having a contract to furnish their city with 75 arc lights of 2,000 c. p. The residents of Millersburg speak in the highest terms of the light, and wonder how it is that they could have been so long satisfied with coal oil.

APPLICATIONS OF POWER.

Laurel, Md.—The Electro-Automatic Transit Company, recently formed at Baltimore, are erecting a generating plant and a railroad about two miles long to test their system.

Montgomery, Ala.—The Montgomery Electrical Street Railway Company have decided to rebuild their plant lately destroyed by fire.

The Baxter Motor Factory, at Baltimore is working day and night in the endeavor to keep up on orders. The company will not, however, be able to keep pace with its growing business until it gets into the new factory, in about three weeks.

Sacramento, Cal.—A special dispatch from Sacramento says: The electric machinery for the Big Bend Tunnel is being put up. It comprises two dynamos, twelve motors, 50,000 pounds of copper wire, and a large lot of different kinds of machinery. The dynamos have a capacity of 140 h. p. and the motors 5 h. p. each. There are two lines of copper wire, one seven miles long and the other ten, and as each is double, this makes about thirty-four miles of wire. The electric power will be used to run the pumps and derricks. The plant was furnished by the Sprague Electric Railway and Motor Company, of New York. A force of men is now engaged in getting everything ready for the immense plant. Three hundred inches of water, with a fall of 300 feet, will furnish the necessary power to run the dynamos.

Distribution of Electrical Power.—The Daft Electric Light Company have issued a magnificent pamphlet on "Distributory Electrical Power Plants," using the Daft system. The pamphlet, which is beautifully printed and bound, gives a well written account of the principles and apparatus employed in the Daft power system, and illustrates a great many special features. Views are also given of the fine new Daft factory at Marion, N. J., and of the power station of the Excelsior Power Company for the east side of New York. There is an interesting section devoted to the question of safe current, and a large number of hearty testimonials from users of Daft motors are given together with long lists of the customers for power in New York City. It is worthy of note that the pamphlet was printed by Daft motor on the presses of J. B. Stilwell & Co., and is a striking exhibit of the adaptability of the power, by its smoothness and steadiness, for such high class work.

PERSONALS.

Mr. Morris Hoopes has been elected superintendent of the West Chester, Pa., Electric Light Company.

Mr. J. B. Thomas, of the Westinghouse Company, has gone to Europe to do installation work in connection with the system, chiefly in Italy.

Lieut. James A. Swift, U. S. Signal Corps, has been ordered from Ashland, Cal., to Astoria, Oregon, for the purpose of inspecting the telegraph and cable there, and superintending its laying across the Columbia River.

Mr. F. H. Tidnam, formerly of Philadelphia, is now located at Elizabeth, N. J., at which place he is superintendent of the electric light station. He has also the charge of the stations at Morristown and Passaic, N. J., which belong to the same company.

Mr. T. A. Edison is the subject of an interesting biographical sketch in the July *Swiss Cross,* the journal of the Agassiz Association. A portrait of the great inventor is given. The article concludes as follows: "He is now in the full vigor of health, and, at the age of 41, finds himself in possession of a well earned and solid reputation. Should that long life, which seems to be a legacy in his family, be vouchsafed to him, very much more of discovery and invention may be looked for from him as the result of his maturer thought and larger experience."

MISCELLANEOUS NOTES.

The Hill Electric Works have been incorporated by E. V. Cherry, H. G. Rich and H. T. Crane, of Cincinnati, with a capital stock of $10,000, to make and sell electric appliances.

Bridgeport, Conn.—The new Aluminium Brass and Bronze Company, of which we have already given details, has decided to locate at Bridgeport, where its buildings will cover an area of 65,000 square feet.

"Carbodium."—A Cleveland, O., mechanic is reported to have hit upon a composition, which he calls "carbodium," to be used in converting electricity into heat. The current is passed through the carbodium, which becomes extremely hot, and can be placed in grates or radiators.

Spycrophony.—A young French officer is said to have invented a microphone which will record and announce the approach of a body of soldiers and give some idea as to their numbers. Surely calling this a microphone partakes of misnomerism. Spy-crophone would be more proper.—*N. Y. Sun.*

Phonograph and Graphophone.—The announcement which we made three weeks ago as to the consolidation of the above interests has now been officially confirmed, as follows: The Edison Phonograph Company, which owns all of Mr. Edison's patents for recording, perpetuating and reproducing articulate speech in the United States and Canada, has been sold to Jesse H. Lippincott, of this city and Pittsburgh, for something over a half million of dollars. All the improvements made by Mr. Edison during the next fifteen years are to come to Mr. Lippincott. By a contract made in March last with the American Graphophone Company, of Washington City, Mr. Lippincott became sole licensee of that company for a period of fifteen years. The graphophone is the rival of the phonograph, and is patented by Tainter and Bell, of Washington. The North American Phonograph Company has just been organized in this city for the purpose of putting these machines into general use. The foreign patents and rights for the graphophone are owned by the Volta Company, of Washington, D. C., and those of the phonograph are still the property of Mr. Edison.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

W. R. Ostrander & Co., of 21, 23 and 25 Ann street, this city, have just issued the sixth edition of their revised catalogue of bell hangers, hardware, gongs, annunciators, electric supplies, etc. It is a publication of nearly 90 pages, full of cuts and detailed descriptions, and gives a good idea of the firm's wide scope. It should be in the hands of all who handle goods in the various lines enumerated therein.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them stating what you want.

Desirable Offices for rent in *suites* or single in the "Hathaway Building," on Atlantic avenue, at the foot of Summer street, next to the N. Y. & N. E. R. R. depot. This is the lightest, sunniest and best ventilated office building in Boston, being fitted up with every convenience, including two elevators for passengers and two for freight, and steam heat. The street cars run past the building to all the railroad depots and steamboat landings in Boston, and but five minutes walk to the O. C. and B. & A. R. R.

The Thomson-Houston Electric Company has engaged the second floor for its executive offices, and other electrical companies are now negotiating for spaces in the building; and the lessor desires to make it Boston headquarters for electric light and other electrical interests, and offers special inducements for those in this line of business to locate here.

For terms and plans address,
ARTHUR H. TABER, Room 27, 3d floor.

The Hill Clutch Works, of Cleveland, O., have just issued one of the most complete catalogue ever issued in the interests of friction clutches. Thir clutch pulley list gives the number of arms on each clutch for different sizes of pulley, space required on shaft, h. p. per 100 turns, shipping weight, list price, and telegraph cipher, to meet the demands of the electric lighting trade, which requires a great many clutches. The desire to place contracts for power transmission machinery with one party, has led the concern to fit up in a most thorough manner for this line of work, which they also illustrate in the catalogue, and which they have been giving attention to with marked success.

The Sawyer-Man Company's New Price-List.—A new but certainly businesslike departure from lamp price-lists usually issued is prominent in the announcement by the Sawyer-Man Electric Company the commercial agent of the Consolidated Electric Light Company of New York, of a reduction in prices to be found in our advertising columns. Candle-power and voltage both determine the price of the lamp, and although it was well known that a lower voltage lamp is cheaper to produce than that of a higher E. M. F., the consumer has heretofore not had the benefit thereof. There are many other announcements they make claiming the attention of the reader, and a perusal of their advertisement is earnestly recommended. Since the completion of the company's factory in New York City, and the enlargement of their Pittsburgh establishment, the business has grown to such an extent that they are required to reorganize their selling department, and they have appointed Mr. P. H. Alexander, their former New England representative, general agent of the company, with headquarters in New York. This action of the Consolidated Electric Light Company, as exhibited in the circular of its commercial agent, the Sawyer-Man Electric Company, following so closely upon the heels of the recent English decision, is preguant with big results.

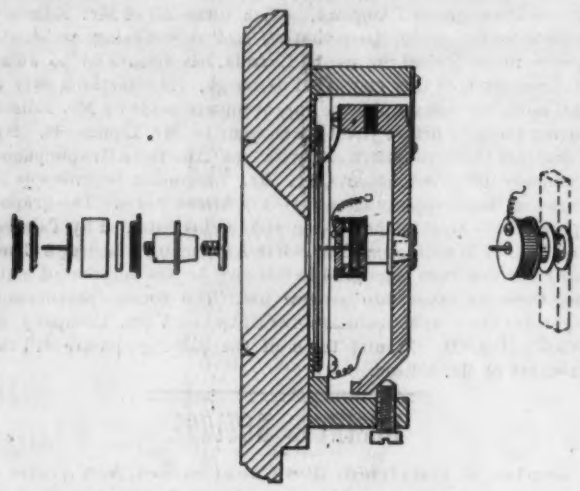
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JULY 17, 1888.

386,103. Secondary Electric Clock Movement; Carl Bohmeyer, of Halle-on-the-Saale, Prussia, Germany. Application filed Feb. 20, 1888. The shafts of the hands are moved by levers operated by an armature so placed as to exercise great leverage while requiring but a feeble current for actuating it.

385,111. Electric Wire Insulator; Henry H. Cutler, Newton, Mass. Application filed Oct. 21, 1887. The insulator is designed for supporting wires on trees. It allows the swaying of the tree without straining the wire. Two insulating rollers are hung side by side with grooves around each, registering with each other. The wire lies in the space formed by the grooves between the rollers.

386,120. Automatic Telegraph Transmitter; Zeroy P. Hotchkiss, Oak Park, Ill., Assignor of one-half to Wm. W. Dudley, of Washington, D. C., and Carlos J. Ward, of Oak Park, Ill. Application filed Aug. 10, 1885. A series of parallel movable strips, series of key-levers below the same, each provided on its upper edge with an arrangement of dot and dash projections corresponding with the arrangement of



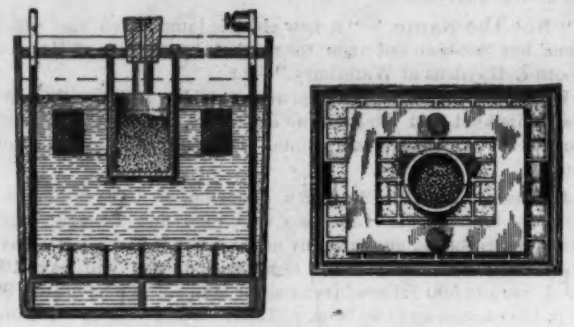
386,380. TELEPHONE TRANSMITTER.

dots and dashes constituting the telegraphic signal or character for the letter sign, or number of the key-lever, each dot projection being adapted to engage one of the strips and the dash projection two or more, according to the length of the dash in the character. See illustration.

(1) 386,149. (2) 386,150. Galvanic Batteries; Abraham V. Meserole, New York, N. Y. Applications filed respectively Oct. 28, 1887, and Feb. 2, 1888. (1) The depolarizing agent used consists of a mixture of carbonate, hydrate and oxide of copper. The porous cup is suspended near the top of the cell. The negative electrode is provided with cells for containing the depolarizer, and is arranged in a horizontal position. This battery is intended to combine the advantages of both the open and closed circuit batteries. See illustration. (2) An alkaline chloride exciting fluid and a depolarizing agent containing hydrate of copper.

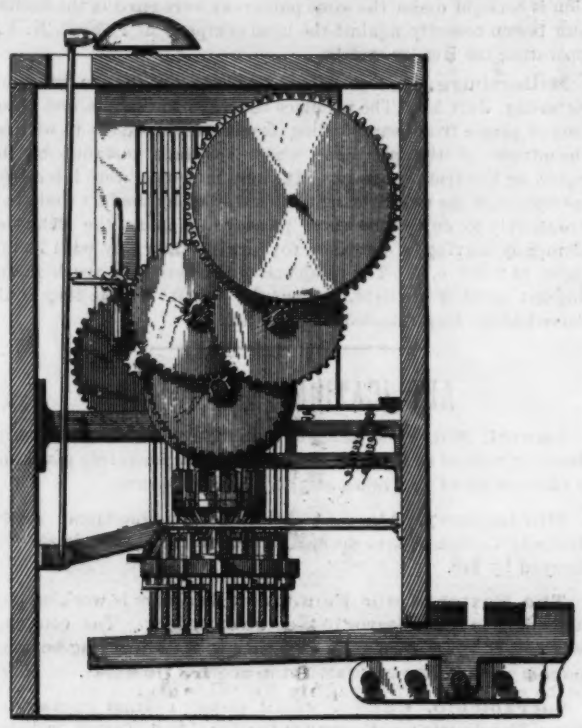
386,175. Police Signal Apparatus; John C. Wilson, of Boston, Mass., Assignor to the Municipal Signal Company, of Portsmouth, N. H. Application filed May 26, 1884. The substations are provided with a multiple signal transmitting apparatus, comprising of a series of signaling surfaces, adapted to change the condition of the current to transmit a determinate signal corresponding with the particular surface employed.

386,184. Electric Railway; Robert A. Cheseborough, of New York. Application filed May 7, 1888. A stationary rack runs the full length of the track, and a gear wheel rotated by an electric motor on the car meshes with the rack, and the car is thus driven along. The rack also serves as the electrical conductor from the generating station to the motor.



386,149. GALVANIC BATTERY.

386,225. Electrical Distribution by Storage Batteries; Geo. W. Walker, Bethlehem, Pa. Application filed March 19, 1888. The invention consists of a series of cells of secondary batteries. A series of switches consisting of three or more contacts, one switch between each pair of cells, electrical



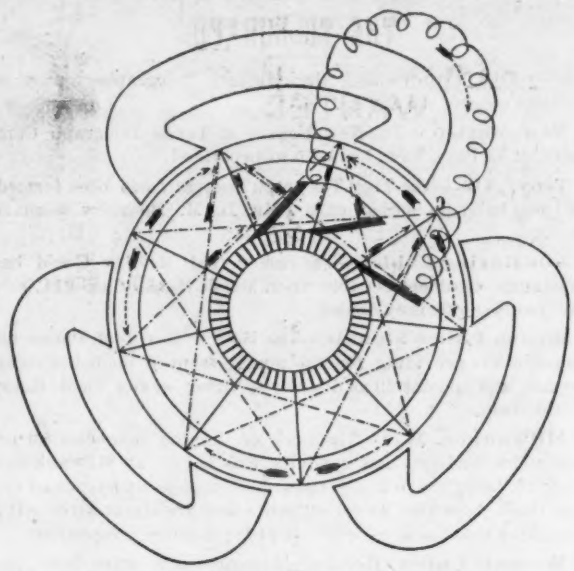
386,129. AUTOMATIC TELEGRAPH TRANSMITTER.

connections between two contacts of each switch and the adjacent terminals of its pair of cells, respectively, and electrical connections between the third contact of each switch and each switch and an electrical conductor.

386,238. Mechanical Telephone; Francis E. Clarke, New York, N. Y., Assignor of one-half by direct and mesne assignments to George B. Van Brunt, Charles A. Hess, and William J. Townsend. Application filed March 9, 1888. The diaphragm is composed of two or more layers of pressed board with an interposed layer of hair cloth cemented by gelatine. The diaphragm divides the box into two chambers.

386,282. Tunnel Construction for Electric Railways; Granville T. Woods, Cincinnati, Ohio, Assignor to the Woods Electric Company, of same place. Application filed May 2, 1887. A yoke for supporting the slot rails, consisting of a base piece adapted to fit over and upon the sides and top, a cross-tie beneath the roadway surface, and two removable jaw pieces adapted to rest upon the base and support angle iron slot rails.

386,340. Dynamo-Electric Machinery; Georges Miot, Paris, France. Application filed March 14, 1888. Patented in France Dec. 5, 1887, No. 187,408, and in Belgium Sept. 3, 1887, No. 78,768. This is a multipolar dynamo having a series of field-magnets with simple magnetic poles arranged about the armature with the several poles nearer to a pole of



386,340. DYNAMO-ELECTRIC MACHINERY.

unlike sign of a neighboring magnet than to the other pole of its own magnet. See illustration.

386,380. Telephone Transmitter; Charles W. Brown, of Montreal, Canada, Assignor to the American Bell Telephone Company, of Boston, Mass. Application filed May 18, 1888. The invention comprises a small containing-case, with metal back and front plates, and a non-conducting rigid side wall. This case has a small orifice at the centre of the back plate through which granulations are introduced, the orifice then being closed by a screw plug upon the end of a metal stem, the other end of the stem being adapted for mounting upon the centre of the adjusting lever of the Blake transmitter. See illustration.

386,441. Apparatus for Electric Welding; Elihu Thomson, of Lynn, Mass., Assignor to the Thomson Electric Welding Company, of Boston, Mass. Application filed July 28, 1887. A plurality of pairs of clamps for holding the pieces to be welded in juxtaposition, and a switch for applying the welding current in succession to each pair of clamps as desired.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—*can be had for* 25 *cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.*

SAWYER-MAN ELECTRIC CO.

COMMERCIAL AGENTS OF THE

CONSOLIDATED ELECTRIC LIGHT COMPANY,

No. 510 West Twenty-third St., New York.

August 1, 1888.

TO ALL USERS OF INCANDESCENT LAMPS.

In view of the increased facilities for the manufacture of incandescent electric lamps afforded by the enlargement of our factories at New York and Pittsburgh, and by reason of the recent valuable improvements made in our lamps, we are enabled to offer the following reduction in prices:

C. p.	50-volt.	75-volt.	100-volt.	C. p.	50-volt.	75-volt.	100-volt.
16 and under	70c.	75c.	80c.	24	80c.	85c.	90c.
20	75c.	80c.	85c.	32	90c.	95c.	$1.00

The above prices are for lamps with our standard bases, and are subject to discounts for central station use and to purchasers of original packages of 250 each.

Three cents will be paid for the return of every lamp base with the platinum wires intact, delivered in good order at either of our factories.

For the purpose of obtaining uniformity of production and of reducing the cost of manufacture, we offer to purchasers of our lamps our standard sockets without charge in exchange for any other socket in use by them.

Experience has demonstrated that the life and utility of the incandescent electric lamp is increased and the cost of manufacture diminished by a decrease of the electromotive force. We have, therefore, divided the commercial lamp into three classes, to wit: A "high" volt lamp (100 volts); a "medium" volt lamp (75 volts), and a "low" volt lamp (50 volts); and, as shown in the above price-list, this company is the first to give to the consumer the benefit of such classification.

CORRESPONDENCE IS SOLICITED.

SAWYER-MAN ELECTRIC CO.